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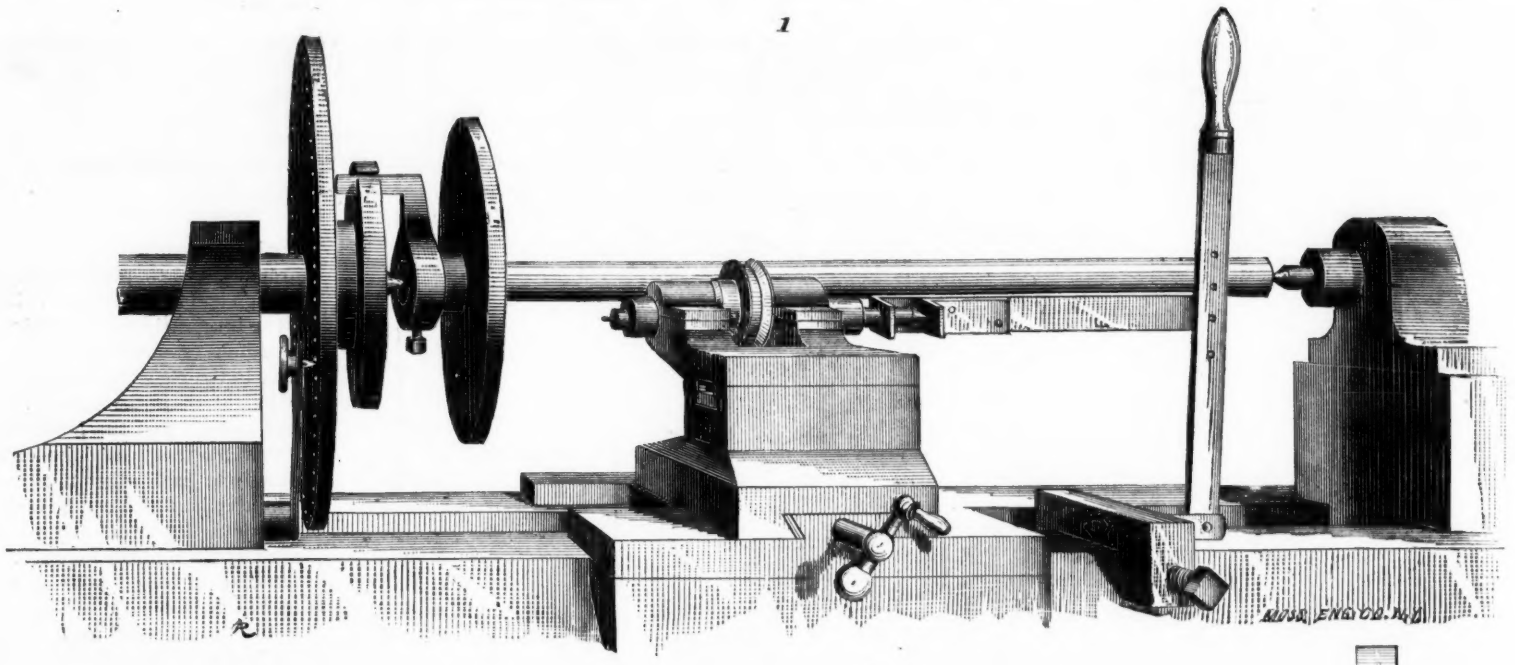


Device for Drilling Index Plates and Grinding on a Lathe.

BY WM. MAIN.

Many machinists need an accurately divided plate for occasional work, but manage to get along without; others manufacture milling machine centers, gear cutters, etc., but are obliged to send the plates to a distance to be drilled by some one possessing a regular dividing and drilling engine.

Technical journals have occasionally described methods of drilling an index plate upon an ordinary lathe. These methods, however, involved various inaccuracies due to following center punch marks, the springing of the drill point, etc., so that the operation is slow, and the result fit only for the scrap pile.

The drilling attachment to be described is simple, does the work rapidly, and the work when done will compare favorably with that turned out by an expensive machine.

It may be used either in copying a standard plate, on an equal or reduced scale, or in originating a plate. By replacing the drill with an emery wheel, or a lap or grinder of any kind, it may be used for grinding cylindrical or conical, external or internal surfaces. Many would find it of value for this purpose alone.

The attachment consists of a drill spindle, driven from overhead, revolving and sliding in bearings secured to the tool block of the lathe carriage. The lathe carriage is stationary while the drill is pushed forward by a lever, having its fulcrum attached to the ways of the lathe.

The general arrangement is shown in Fig. 1, where the standard index plate *a*, attached to the back of the face plate of the lathe is to be copied on the smaller plate, secured on a mandrel between the lathe centers.

The drilled side of the index plate *a*, is turned toward the head-stock of the lathe, and the stop pin on the end of a piece of stiff spring steel, secured to a stout stud screwed into the head-stock.

The support of the drill spindle is shown in Fig. 2. The cylindrical portion of the casting is drilled and reamed out to a $\frac{7}{8}$ hole, and the middle of this part cut out to receive the small V pulley.

The under side must be planed off parallel to the line of the bearings; saw cuts made at *b*, and the tightening screws *c*, *c*, put in.

The drill-spindle is of steel, with an accurate half-inch hole through the center, carefully turned, and afterward ground in its bearings, so that it may slide and revolve smoothly.

A round steel rod slips into the hollow spindle, and is secured by the screw *d*. The outer end of this rod has a rectangular groove turned in it, and terminates in a point like a lathe center. This point should be hardened.

The drill is mounted in a brass plug, made by drilling a short piece of brass rod from end to end with the drill to be used, then turning it down till it will just fit in the spindle. A slight swell should be left at the end next the drill point, so that from $\frac{1}{4}$ to a third of an inch will project while the plug sticks fast in the hole. This outer end must be flattened on opposite sides, so that the drill can be taken out with a wrench.

To secure the drill in the plug, push it into

place and hold the end of the drill in a bit of wet rag with a pair of pliers. Heat the plug over a lamp, and apply a drop or two of soldering fluid and solder. Only as much of the end should project as is really needed.

The small V pulley is secured by a set screw bearing against a flat place on the spindle. The gap between the bearings must be wide enough to take in the pulley, where the drill is run in the lathe, and the plate mounted upon the carriage. By the plan described, this source of error is avoided, friction is less, and the holes drilled with great rapidity.

The lever is pivoted into a stud, screwed into a bar of square iron which is bent twice at a right angle, and secured to the bed of the lathe by a set screw. The stud screw should have a set nut, so that it can be turned or held fast in any position. A small counter-shaft, carrying a drum directly overhead, drives the drill. When a circle of holes is completed, the cross feed-screw is turned a certain distance, bringing the drill in position for the next circle.

To originate the divisions of a plate, a strip of brass must first be drilled with a line of holes exactly spaced.

To do this, take a small rectangular plate of steel, somewhat wider than the strip to be drilled. Rivet to one side of this two parallel strips of metal, slightly thicker than the brass hooping, and at such a distance apart that it will just slide between them. Then file a bit of flat iron to the exact width of the brass, so that it too will just slide between the guides on the plate. Drill a hole in this bit of iron about the middle of its width, and, placing it between the guides, drill through the steel plate also. Move it along a suitable distance (to be seen hereafter), and drill a second hole through the steel plate, using the bit of iron as a guide.

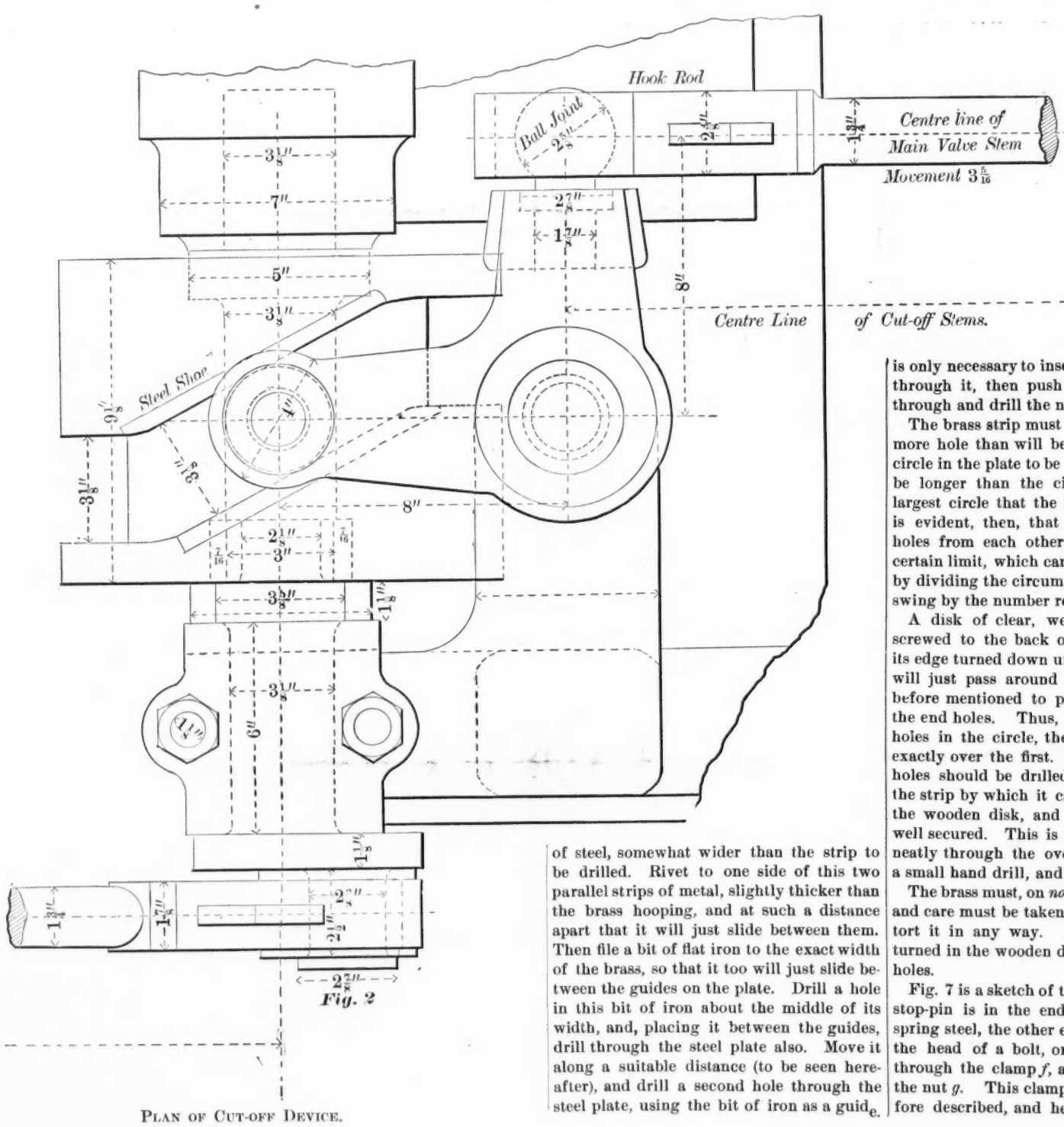


Fig. 2

PLAN OF CUT-OFF DEVICE.

A second steel plate may now be riveted to the first, being separated from it by the metal guide strips, and the holes in the first continued through it.

We have now a spacing-plate through which the strip of brass will slide snugly, and in which the line of the two holes is exactly parallel with the direction in which the brass hoop will slide. Having made a pin fitting the holes exactly, *clear through*, it is only necessary to insert the hoop and drill through it, then push it on, pass the pin through and drill the next hole, etc.

The brass strip must contain, at least, one more hole than will be found in the largest circle in the plate to be drilled, and must not be longer than the circumference of the largest circle that the lathe will swing. It is evident, then, that the distance of the holes from each other must not exceed a certain limit, which can be easily calculated by dividing the circumference of the lathe-swing by the number required.

A disk of clear, well-seasoned wood is screwed to the back of the face-plate, and its edge turned down until the strip of brass will just pass around it, and allow the pin before mentioned to pass through both of the end holes. Thus, if there are to be 100 holes in the circle, the 101st hole must lie exactly over the first. A number of small holes should be drilled along the edges of the strip by which it can be tacked around the wooden disk, and the ends, especially, well secured. This is best done by drilling neatly through the over-lapping ends, with a small hand drill, and tacking down.

The brass must, on *no account*, be punched, and care must be taken not to strain or distort it in any way. A groove should be turned in the wooden disk under the line of holes.

Fig. 7 is a sketch of the arrangement. The stop-pin is in the end of a piece of stout spring steel, the other end of which is set in the head of a bolt, or stud, which passes through the clamp *f*, and is held solidly by the nut *g*. This clamp is made like that before described, and held by a set screw to

and also allow the proper traverse to the drill. The hub of the pulley is turned toward the drill, and serves as a stop, bringing up the drill at the proper point, and securing uniform depth to the index holes.

The drill is advanced by the lever *e*, having its fulcrum on the ways of the lathe, and connected with the drill spindle by the L-shaped link of flat steel shown in Fig. 5. A slot, open at the bottom, allows the link to drop on the neck of the rod, and serves to pull the drill back. The drill is pushed forward by a smaller L-shaped piece of flat steel riveted to the side of the first. This bears against the pointed end of the rod, and should also be hardened. It will be seen that the lathe carriage remains stationary. Its gibs may be tightened up solidly, as it serves only as a guide for the drill. The lever, it is true, might be dispensed with, and the whole carriage advanced each time. This would be slower and more laborious, a matter of some importance where many thousand holes are to be drilled, and also far less accurate, as the tendency is to tip the carriage back from the resistance of the drill, especially as the gibs must be slack enough to allow it to move. This is also the fault of methods of drilling index plates

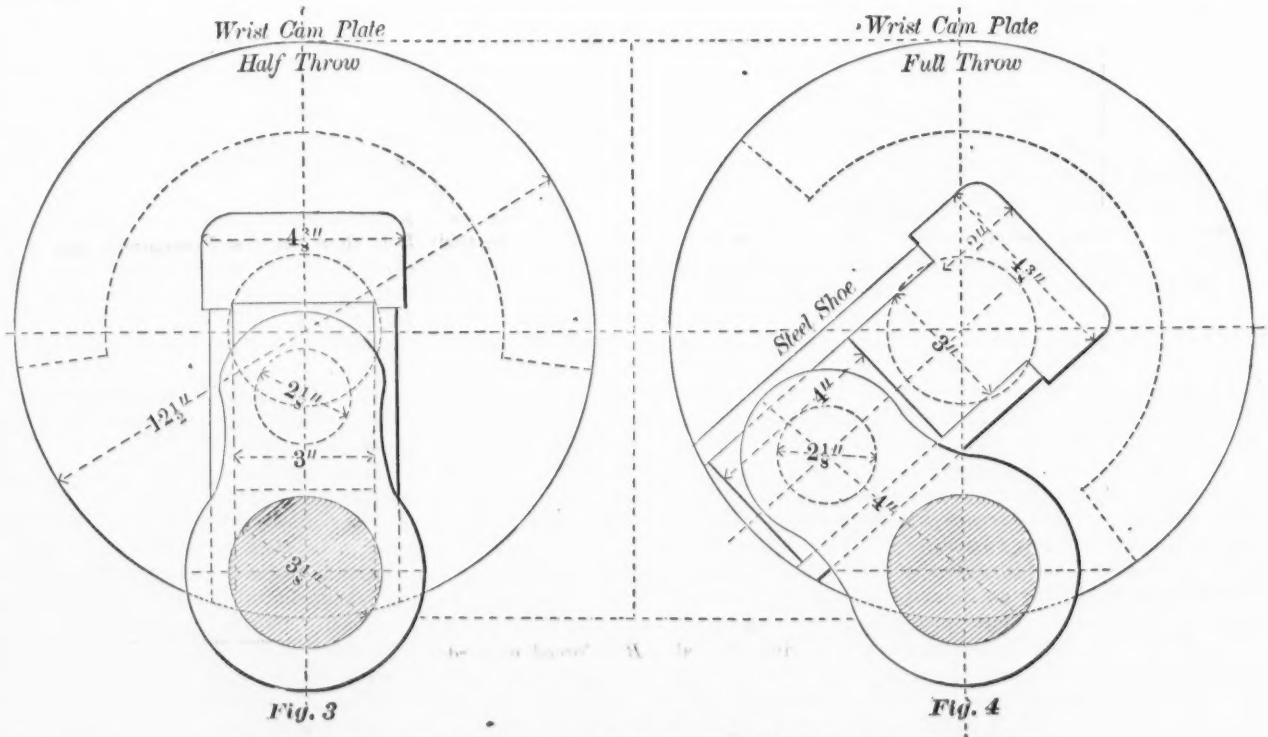


Fig. 3 Fig. 4

WORKING DRAWING OF 100 H. P. STEAM ENGINE.—WRIST PLATE.—3″=1 FOOT.

the lathe-bed. When a complete circle has been drilled, the strip must be removed, as much of it cut off as is necessary for the next circle; the wooden disk turned down till just small enough, and the strip again tacked on. In turning down the wooden disk, a tool-rest can be extemporized to avoid disturbing the drilling arrangements on the lathe.

For the smaller circles, instead of cutting the disk down very small, it is better to have another strip drilled with holes further apart, and to fit it on a new disk of full size.

When a plate is to be drilled in regularly consecutive numbers, it is desirable to start the circles with some reference to each other, so that the plate will suggest to the eye pleasing geometric lines, instead of having an irregular appearance suggestive of inaccuracy. For this purpose, a cleat may be tacked on the side of the wooden disk in a radial direction. A straight edge laid against this, to which a particular point in the strip is brought each time, will secure a regular appearance in the plate, provided the relative positions of the wooden and iron plates are not altered.

Plates to be drilled should not be polished, as the emery in the pores of the iron will spoil the point of the drill. Changes or adjustments must be avoided till a circle is completed.

The circles in full index plates usually vary by even numbers. Thus, a plate with 150 holes in the largest circle will contain 38 circles with 76 holes in the smallest, or 4,294 holes in all. This will give all even numbers from 150 to 76, and by halving, quartering, etc., all numbers from 75 down.

Fig. 4 shows the method of using the spindle for grinding. The emery wheel is held on a rod passing through the spindle, and drawn tight by a nut at the other end.

The pulley may fill the space between the bearings, and the lathe carriage be made to traverse automatically or otherwise, while both the work in the lathe and the emery wheel are in rotation.

For grinding conical surfaces, the axis of the grinding wheel may be set at an angle with the line of lathe centers, either by clamping the attachment at an angle, and causing the arbor to traverse with the lever, or with a compound slide rest in the usual way.

When the arbor of the grinding wheel is to slide or traverse back and forth, it is better to put a feather in the hub of the pulley, and cut a groove in the arbor, so that the pulley while driving the emery wheel may allow it considerable traverse. The connection between the lever, the ways of the lathe and the arbor, is of the nature of a universal point, and can be operated when the drilling or grinding arbor is at an angle with the line of lathe centers. For drilling it would be undesirable to place the fulcrum of the lever on the lathe carriage for reasons before mentioned; for grinding this might be a convenient arrangement.

The Scovell Pop Safety Valve.

A safety valve should allow no pressure to accumulate beyond the point at which it may be adjusted, nor should it discharge an excessive quantity before closing. Ever since the days of the illustrious Doctor Papin, the common type of valve has existed with its peculiar and numerous disadvantages. Its supreme fault is its limited action, and its lift decreases with adjustment for high pressures, making its operation especially restricted. So slight is the lift of an ordinary valve that with a diameter of six inches it gives an opening of less than one square inch of area. In consequence of this imperfection increased diameters are introduced, involving large friction surfaces with their accompanying corrosion. Prominent among the various enemies to perfection, there is the danger attending the exposure of a safety valve of the common form, with its extended lever stretched forth to receive any treatment which the careless may wish to employ. Thousands of such steam boiler adjuncts can be seen actually offering disaster and ruin, overloaded with bricks, stones, car links, pokers, and occasionally a brace can be found extending from the lever of these valves to the roofs above them.

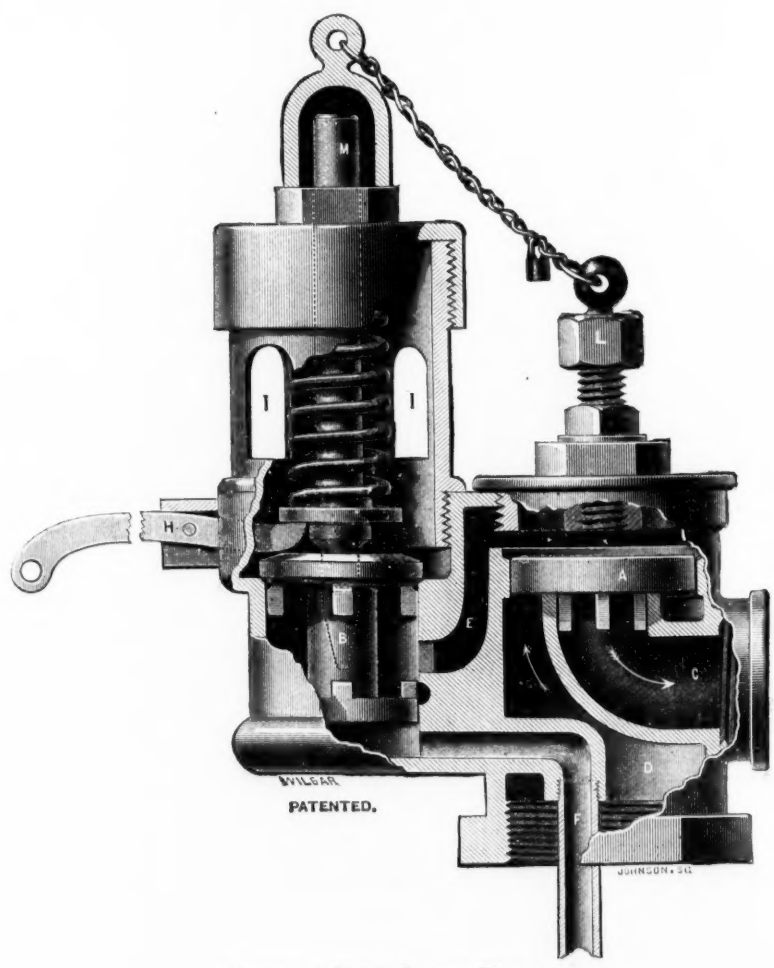
The Scovell "Pop" Safety Valve, for locomotive, stationary, portable and marine boilers, illustrated upon this page, has recently been brought out by the Hancock Inspirator Co., Boston, Mass.

The passage *E* forms the steamway between the valves *A* and *B*. The passage *F* conveys steam from the boiler to the valve *B*. The passage *D* conveys steam from the boiler to the main valve *A*.

The set screw *L* is for the purpose of regulating the lift of the main valve *A*.

The cap surrounding the spring spindle *M* regulates the tension of the coil spring.

The lever *H* is for the purpose of opening the valves by hand. The openings *I I* are for the purpose of allowing steam to escape into the atmosphere from the valve *B*. The elbow pipe *C* is for the purpose of allowing the steam to escape into the atmosphere from the valve *A*. The lock and chain secures the valve against being tampered with. The main valve *A* and lower disc of valve *B* are fitted so loosely in their cases, that steam passes freely around and above them, constituting a counter-pressure above the main valve *A*.



SCOVELL "POP" SAFETY VALVE.

In operation, the valve *B*, it will be understood, simply operates the valve *A*. The main valve *A* relieves the boiler. Atmospheric pressure acts upon the interior of elbow pipe *C*. The main valve *A* and lower disc of valve *B* are fitted so loosely in their cases, that steam freely passes around and above them, forming a steam counter-pressure or load above the main valve *A*, which holds it down on the top of elbow pipe *C*, which forms its seat. When the valves are at rest their chambers are filled with steam at boiler pressure, and *at all times* the boiler pressure acts upon the lower disc of valve *B* and the annular space surrounding the seat of main valve *A*, but not so above them, as will be observed from the following description. The above description refers to the valve at rest. Its action in "blowing off," is as follows: As soon as the boiler pressure becomes greater than the resistance of the coil spring, the valve *B* is forced upwards from off its seat. As this occurs, the steam pressure above the main valve *A* and lower disc of valve *B* begins to escape into the atmosphere, through the seat of valve *B* and openings *I I*. The boiler pressure continues to increase slightly until the valve *B* has opened sufficiently to allow the steam load above the main valve *A* to escape through the passage *E* and through the seat of valve *B*, and into the atmosphere more rapidly than it can get on top of and around the loosely fitted valves. The main valve *A* then opens to its full height, and relieves the boiler of its excessive pressure through the elbow pipe *C*, when the coil spring again forces the valve *B* back to its seat, causing the pressure to again accumulate in the chamber above the main valve *A*, and force it back to its seat on top of elbow pipe *C*.

The trip lever *H* is so arranged that a downward pressure causes it to lift the spring, and causes the valves to "blow off," but an upward movement of the lever will not exert any force on the valve to hold it down. The pressure can be easily changed at any time, by altering the tension of the coil spring with the cap screw.

It is claimed for the Scovell "pop" safety valve, that its relieving capacity is not restricted, and that it lifts to its full height with all pressures, presenting an opening equal to the area of its discharge pipe. Its seats are of the simplest form, and its precision of action is not subject to derangement by the wearing of its valves or their seats. No especial adjustment is necessary, and the seats can be reground or renewed without especial skill. Its friction surfaces are reduced to a minimum. The spring is not subjected to violent and sudden compression. It is thoroughly self-contained, and is exempt from the dangers of being tampered with. It opens with promptness and closes with a slight loss of pressure.

It is constructed of the best steam metal, which affords the greatest immunity from corrosion. These pop valves are maufactured with or without flanges and of various modifications, to meet all conditions. The outlets are also made suitable for locomotive and portable boilers, where no escape pipe is required. The manufacturers are the Hancock Inspirator Co., 34 Beach St., Boston, Mass., and Stevens, Turner & Burns, London, Ontario.

A meeting of capitalists was held in Catskill, N. Y., Sept. 9, presided over by ex-Congressman Bagley, at which it was resolved to build a railroad from Catskill to the mountains and the interior towns, to accommodate summer travel, and three-fourths of the stock was subscribed. The road is to be built especially to accommodate the thousands of summer boarders who resort to this region every year. No railroad now reaches Catskill.

Working Drawings of a Steam Engine.

On the opposite page we present two working drawings, of parts of a 100 H.P. steam engine, by W. H. Hoffman. A number of other working drawings of the same engine, have been presented in our issues of Jan. 3, Jan. 10, March 27, June 12, June 19, July 10, July 17, Sept. 11, and Oct. 2. We regret to be obliged to discontinue publishing the drawings of this engine, on account of the large space required for them, and the press of other matter that cannot well be crowded out.

Besides the cam-wrist-plate motion, is the block and groove in face of wrist cam, shown by Figs. 3 and 4. When the block is in position, as shown in Fig. 3, the valve is about to open, and it will be observed that the motion must be *very* rapid, while the position of block, as shown in Fig. 4, brings the plate to a dead halt, before the eccentric has given its greatest throw.

Of course, the compression can be regulated, as well as the points of release and opening, by the formation of slot or groove in edge of cam, but the drawing shows a true spiral, the exhaust steam being compressed to within fifteen per cent. of initial or chest pressure.

The bell-crank shaft and hook-rod arm are steel castings, while all pins are steel, working in gun-metal boxes.

The whole motion is firmly bolted, with its stand, to a plate attached to main bed.

Insuring Steam Engines against Accidental Breakdowns.

In the August 13th issue of *Engineering*, a novel form of insurance is mentioned, with some degree of commendation. Insuring steam boilers against accidental breakdowns, is a department of the business of the Engine and Boiler Insurance Co., of Manchester, England, which is equally novel in England, and in this country, whether as an addition to the ordinary system of boiler insurance, or taken separately upon its own account. By a system of expert inspection, owners are warned of coming danger, and breakdowns, with their accompanying loss of time and wages, for, perhaps, hundreds of employees, prevented. In the company's report, an analysis of the accidents to insured engines is given, from which it appears that 49% were attributable to accidental causes, 14% to the negligence of attendants, 20% to old flaws or defects, and 14% to weakness or faulty construction. In this country numerous experts are giving attention to the condition of engines in daily use, but none have gone into the business of insuring engines on business principles.

About 150 cases of goods, for the American Exhibit, at the International Exhibition, Melbourne, were lost by the wrecking of the ship, Eric the Red. This will prove a serious loss to our national representation at this exhibition, for the great distance precludes sending more goods to take the place of those lost. The exhibition opens October 1, and continues six months.

The decline in farm labor and wages which had been steadily going on since 1879 till last year seems to have been arrested, and there is a decided advance in almost every section. The average wages of labor engaged by the year or season, and which represents the steady and trustworthy force on the farms, was for the whole country last year $20.26 a month, without board. This year it is $21.75, being an increase of 7.25 per cent.

The Cincinnati, Hamilton & Dayton railroad company has made a proposition to remove its shops from Cincinnati to Dayton.

Extracts from Chordal's Letters.

Mr. Editor:

* * * * Sackett lately employed a new man; a man with testimonials; a man who had taken two or three degrees; a man who had a college's authority for writing C. E. after his name; a man who was no civil engineer after all. He was not smart; he was simply learned. He had no knowledge; he had simply education. Judgment cannot be based on education; it must be based on knowledge. This C. E. had no knowledge and no judgment. He was a nice man, and a learned one, and a C. E., but Sackett bid him good bye after three weeks' knowledge of him. I don't know who wants such men. Sackett says he don't, and I know for a certainty that Wycoff don't.

* * * * When Sackett told me of his experience with this man (he was no youth just out of college, mind you, but an old hand, if he was a weak one) our conversation naturally turned on titles. I mentioned that I had read, in several places, that C. E., &c., could be rightfully affixed to a name only after permission had been conferred by some educational or similar body; and that others assuming such titles did it for the purpose of leading to the inference that they had such formal right to it; and that merit alone would seldom tempt a fair-minded man to appropriate such a title.

"Bosh!" said Sackett, "the writers of such stuff don't know exactly what they are talking about. An engineer is a man who has had the title conferred on him, whether he is an engineer or not; or he is a man who is an engineer, whether he has had the title conferred upon him or not. Both these men have a right to the title, and either should blush to take it if not properly endowed. Even if conferred by a college, the conferree should hesitate before he accepts such a vocative title as Engineer. M. D. at the end of a man's name indicates that he is a doctor of medicine. Doctor is a word with a meaning not at all analagous to surgeon, or physician even. No college, or course, can make a man a surgical man, even though they endow him with the title of surgeon.

"F. R. S. is not a vocative title. It can only be properly conferred by the Royal Society, and after they confer it the man is a fellow of that society. Ph. D. means that a man has received the title, and not that he is in reality a doctor of philosophy. Engineer or C. E. at the end of a man's name, indicates that the man has an engineer's title, or an engineer's vocation.

"It is not a sure indication, because the man may be a fraud. He may not be an engineer at all, and he may never have taken a degree. I have got," continued Sackett, "two captains and one major working out in my foundry. They have no right to the title, because they never had it conferred by any proper authority, and they never fulfilled the functions the title would indicate. If they saw fit to write moulder, or sand rammer after their names they would be right, even if there was such a courtesy title, because the word is vocative. I have a designer upstairs who has a right to put M. E. after his name, because he is a mechanical engineer and a good one, though he has no diploma; and he has a right to put M. D. after his name, because he has studied medicine, and has a diploma. He is a good engineer, and no physician."

* * * * I tried to find out from Sackett what had been the trouble with his late C. E, but I failed to get anything but indefinite grumbling. I gravely suspect that the aforesaid C. E. had been trying to rush some "correct mechanical principle" into Sackett's work, without regard to the expense or propriety of it; and that some of this "principle" has failed to operate, and has consequently got Sackett into trouble.

I judged this from Sackett's saying, "Business is business, and I find that I have got a lot of customers who would rather have a bad thing which did its work well than a good thing which wouldn't do any work at all."

* * * * I got a letter yesterday from one of the best machine shop managers in the United States, asking who Sackett was, and stating that he would like to form his acquaintance. I could not give the party Mr. Sackett's specific address, though you have attempted to do so in printing the back of one of his drawings in a late issue. Another gentleman wrote me, through you, asking to be told where Bennett's shop was. Few men enquire about Wycoff. I wish to take this occasion to answer all such inquiries.

If you want to see Bennett's shop, you will have to travel in several different directions, for his shop is scattered. His foundry is in one state, his machine shop in another, his line shaft in another, his pattern shop in another, and his excellent intention of doing something to keep castings from littering up the machine shop is in several states, principally in a state of uncertainty. When the elements of Bennett's shop are combined in one geographical section, I want to be on hand at the opening.

Sackett and Wycoff are men who are ubiquitous in different proportions. I would describe Wycoff as a good-looking gentleman of almost any age, a good and lively citizen, a man tolerably well fixed in the world, a pleasant man to meet, no specially bad social qualities, and a very numerous and short-sighted machine shop manager. I would describe Sackett as a good looking gentleman of at most any age, a good and lively citizen, a man tolerably well fixed in the world, a pleasant man to meet, no specially bad social qualities, and a very long-sighted machine shop manager.

If I should show you their portraits, they would look much more alike than two pieces of some of the interchangeable machine work we often hear about. Outside the shop you can only distinguish them by the relative increase in their wealth, and that of their employes. Inside the shop they are readily distinguished. The front of the shop tells whose shop it is. If you see any old, rusty, odd bevel gears half buried in the earth before the shop, or behind it either, it is Wycoff's shop every time.

They come from different lines of ancestry, but have traveled the world together. Their ancestors discovered the new world as they sailed together. One furnished the reckless daring, the willing muscle, and the devil-may-care readiness to go I don't know where; while the other brought the cool head, the definite intention, the best attainable chart, the compass, the glass, and a brave, prudent energy.

* * * * Very respectfully,

CHORDAL.

Improved Crane Neck Steam Fire Engine.

The accompanying cut shows an improved Crane Neck Steam Fire Engine, built by the Clapp & Jones M'f'g Co., of Hudson, N.Y.

It will be remembered, by those interested in such matters, that the engines built by this company were accorded the highest honors at the Philadelphia Exposition of 1876, and at the four days' competitive trials that then took place, made a total record comprising superiority over all competitors, in every substantial point in the construction of a good steam fire engine, as stated in the report of the judges.

Until within the past year, this company had not built anything except horizontal engines, but the demands for their machines for use in large cities having narrow streets, led them to construct a crane neck engine that could be turned in its own length.

The ordinary crane neck engine is a very complicated affair, with the pumps and other working parts very difficult of access. This engine is in construction very simple, having no unnecessary complications. The pumps are double-acting, and have both ends alike, so that valves will fit closely and perfectly in either end. The whole pump can be taken apart in a quarter of the time required for that purpose in the ordinary crane neck engine.

These pumps are made entirely of composition, and are, therefore, non-corrosive and non-rusting. There are no springs required on the valves, and no leather or rubber is used on the plunger. The plunger displacement is unusually large in proportion, and water can, therefore, be forced to a greater height than in the ordinary fire engine.

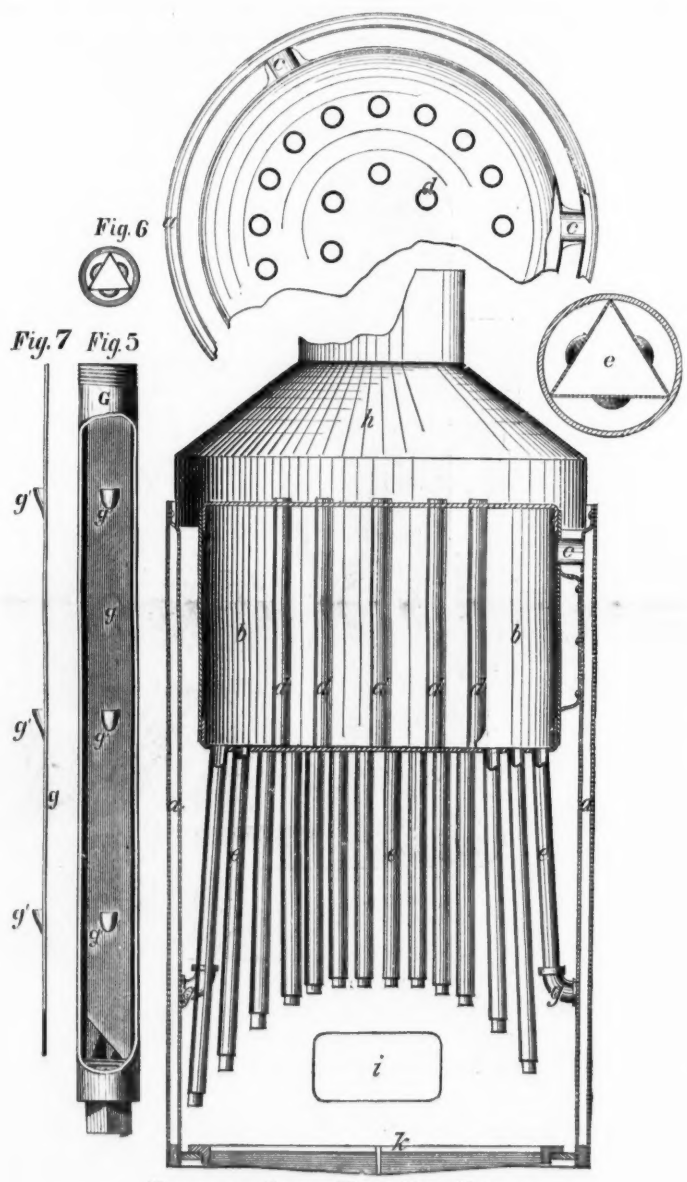
The machinery is so arranged as to make the severest strain come where all parts of the framework must share in bearing it; and it is also so arranged as to make it impossible to throw the working parts in the least out of line, or to injure them by any strain received in running to a fire.

All parts of the engine are evidently made with care and exactness, and the entire construction is such as to insure power and durability.

The boiler has great steaming capacity, and is provided with a peculiar self operating arrangement for the circulation of the water, which is of the highest importance in boilers that operate so quickly, and are required to make so much steam in so small a space as is necessary in steam fire engines. It is claimed that steam can be generated from cold water in *from three to five minutes* from time of lighting the fire. The boiler is so constructed that every part can easily be got at in case repairs are needed. The tubes are screwed in the tube sheet and can be taken out and replaced in a very short time. The manufacturers declare these boilers will not foam or prime, as most others do that are used for this purpose, and that they will bear the strongest firing without the least danger of overheating, and will make all the steam that can be used in the engine. Where fresh water cannot be had, salt water can be used.

A section of the improved Clapp & Jones boiler is shown herewith. It is vertical, with both fire and water tubes. *a, a,* shows the outer shell of boiler. *b, b,* is a suspended chamber or drum for both steam and water, and is supported by three offsets or pockets, that are raised from the sides of the drum to meet, and rivet to, the inner sheet of the shell, *a,* holding it firmly in place. *c, c,* are tubes connecting drum, *b,* to shell, *a,* for circulation of water and steam. *d, d,* are the fire tubes, made of seamless copper and extending from the lower to the upper head, giving the proper distribution of heat among the lower tubes, *e, e,* and also to act as additional stays between the two heads. *e, e,* are the water tubes, pendant from the crown of the fire box and screwed into it. The outer rows extend nearly to bottom of fire box and surround rows of shorter tubes, which are about half the length of the outer row. One of these water tubes is shown in Fig. 5, and is broken away to exhibit the arrangement provided for the circulation of the water. Fig. 6 is a transverse section of the tube, showing the diaphragms, one of which is seen detached in Fig. 7, which are arranged so as to form a triangle when inserted in the tubes. In this way the water is isolated into thin films or sheets, so that the generation of steam will be very rapid—the diaphragm serving to establish return passages for water to supply the place of that converted into steam and carried up by steam. By the arrangement of openings, *g', g',* much of the water lifted will be allowed to return to the return passage, without passing all the way up to the top of the tube. As stated, the drum is fastened by offsets or pockets. *g, g,* are tubes with elbows, that connect the drum, *b,* with leg of boiler for supplying the drum and the pendent tubes with water; *h,* the smoke bonnet, *i,* the fire door, and *k,* the grate bars.

The connections of the engine to the boiler are made so that there are no steam pipes exposed to the cold air, or joints to become leaky. One of these engines was recently built for the city of Hartford, Conn., and was subjected to a very thorough test at the hands of two experts, residents of Hartford. The new engine was tested with an efficient engine (No. 7) which had been in use for some time, and gave extra satisfaction. The conditions of the test were: for each engine, 200 feet of cotton hose, 1½ inch nozzles, duration one hour, starting with 30 pounds of steam; the number of revolutions was recorded by a counting machine and the aver-



BOILER OF CRANE NECK FIRE ENGINE.

age of twelve observed records was taken as the mean velocity. Steamer No. 7 consumed 726 pounds, and the new engine 706 pounds of fuel. No. 7's cylinders were 7⅞ inches with 8 inch stroke, and the new engine's 8 inches with 7 inch stroke. The pumps were: No. 7's, two of 4½ inch diameter by 8 inch stroke; the new engine's, two of 5 inch diameter and 7 inch stroke. No attempt was made to determine the actual amount of water discharged by each, but assuming that each pump discharged its full capacity at each stroke the results would be: For No. 7, 442.64 gallons per minute; and for the new engine, 533.31 gallons per minute.

The new engine made 23 more revolutions, yielded nearly 10 pounds more water pressure, gave more than one pound more to each pound of coal, and displaced 23,854 more cubic inches of water in a minute. The report concludes with the statement that the new engine more than fulfilled the requirements of the contract, and is a credit to the builders.

To make Belts run on the Center of Pulleys.—It is a common occurrence for belts to run on one side of the pulley. This arises from one of two causes. 1st. One or both of the pulleys may be conical, and of course the belt will run on the higher side. The most effectual remedy for this would be to straighten the face of the pulleys. 2d. The shafts may not be parallel, or exactly in line. In this case the belt would incline off to the side, where the ends of the shafts come the nearest together. The remedy in this case would be to slacken up on the hanger bolts, and drive the hangers out or in as the case may be, until both ends of the shafts become parallel. This can be determined by getting the centers of the shafts at both ends by means of a long lathe, or a light strip of board.

A Philadelphia concern has recently received an order from one of the leading steel firms in England, for sample lots of sand for foundry purposes. The superiority of American castings, especially in fine work, appears to be conceded. This is a more sensible move than importing water from Sheffield to temper razors in Bridgeport.

Letters from Practical Men.

POLISHING CAST IRON.

Editor American Machinist:

In reply to the call from Chordal, Aug. 28th, for a lathesman to tell what he knows about finishing up work in a lathe, I must first observe, he don't say what kind of metal he is working on, or finishing. If he is working on wrought iron, he takes a poor way of finishing by using two files. If he has a nice piece of work, so much filing will file it out of round. When he was taking the finishing cut with a fine feed and a little soda water, he could do away with much of the filing, and have a better job, when done. His method is to file in oil with a fine file. But oil costs money, and chalk will answer as well, besides not spoiling the file for another job; files are expensive, too. Then he says, use emery paper to cross and recross on the work, till the straight scratches disappear. Next comes the polishing part; he uses two pine clamps. In my opinion, if he used them after the file he would do just as good a job, and in less time, than by rubbing with cotton waste filled with flour of emery, for all the force he could get out of that would not have much effect, because he could not put much power on it; he could not finish cast iron that way. After roughing off that metal and leaving small tool marks in it, a man should always use a scraper, as it don't get the work out of true like a file. If the work you have in the lathe chatters, put a small piece of soft substance under your scraper—such as a thin piece of belting, then the chatters will be very light. When all tool marks are out, and a little polish appears, take a piece of sheet lead and tack it on a piece of wood as near as possible to the shape of the work. Then with oil and emery, as coarse or as fine as desired, all marks may be got out of the metal, and a nice job be the result in a short time. Of course, in using the scraper and lead stick you must run as fast as your work will allow; and a man working must turn out as much work as he can in the least time, and good work, too.

Yours truly,

Edward B. McDonough.

South Boston, Mass.

PATENT GRINDSTONE DEVICE—DRAWING TO SIZE.

Editor American Machinist:

There has been considerable in your paper on the subject of grindstones, and I wish to add my little mite.

In the shop in which I work there are three grindstones on the first floor, and they are kept true by having a steel roll, on which has been cut a V thread, about eight to the inch. This roll is hardened and runs in a frame which is attached to the grindstone trough, and is moved as the stone wears.

When a workman finds the stone runs out, he simply turns a little wheel, to which is attached a screw that brings the roll spoken of to bear on the grindstone.

The stone makes the roll revolve, and in two or three minutes the grindstone runs true. This is done as often as it is found necessary, perhaps four or five times a day. We never hear any complaint about the grindstone. This grindstone trueing device is patented, and is made by the company.

I do not agree with Chordal in not making drawings to size. When they are thus made the workman can verify his measurements. Our drawings are almost all made this way, and are as large as 24x24. They are varnished and put on card-board $\frac{5}{16}$ of an inch thick. Last month, while the shop was stopped a week, the floors and benches were all washed so that they looked as clean as those in our kitchens.

Providence, R. I. M. C.

POLISHING IN A LATHE.—SOME HINTS ABOUT GRINDSTONES.

Editor American Machinist:

The question raised regarding "polishing in the lathe," I think a very proper one, especially so, when considering that many of our machinists, and good mechanics too, do not fully comprehend what polished work really is.

It has been my experience to have a great variety of machinists to deal with, and any one who has given the single and very important matter of "polish" a careful thought in his work and the work of others, has, no doubt, been surprised at the degree of variation that different machinists have been trained to, or, perhaps, I should say, have trained themselves to, for it is not every foreman who is capable of criticising intelligently this simple matter. Neither is it every foreman who takes time, or thinks it important to examine this portion of the work, provided other requirements, no more specifically called for, are satisfactory; consequently, we find good mechanics everywhere who have a very imperfect knowledge of its meaning. Specify a polish to them, and you simply convey the idea of high finish without the brilliant hard surface; and the only way, if you are particular about your work, and have your heart in your business, is to take the time and patience and explain to each man just what you mean, and the difference between simple high finish and good polish.

Now, the difference between the two is this, speaking superficially: The high finish looks first-rate, and is first-rate, while the job is in the shop—especially if it is a dark, gloomy shop—and constantly being handled with greasy hands and being wiped with clean waste; but as soon as the work is off your hands, and permitted to stand in daylight, with, possibly, a moist atmosphere, it will soon be found that oxide will form, until you have spent any amount of time and muscle on it, when at last you have, by continued hard work, nearly accomplished what should have been attained before the parts left the shop, and the hard, grainless, glassy surface resists the action of the atmosphere and salt from the hands. This is especially important in locomotive work.

Then, again, polish is required as an anti-friction medium, particularly in hydraulic work, where the problem of friction is of great importance.

Polish also enters into the wearing problem, for the higher the polish and truer the surface, the longer and more perfectly will the part wear.

How often we say of such and such a journal or machine: "It will run all night and keep cool and not cut when worn down to its bearings." We mean by that, that the wearing surfaces are getting themselves into that state of high polish that enables them to run free from fine cuttings. All the surfaces are frictionless in contact and carrying their proportion of load while being evenly oiled. Then, and not till then, does everything work well.

It would be difficult to imagine two good surface plates, kept properly oiled and working together under a load, being cut or heated.

I have often stood and draw-filed piston rods and valve rods, etc. This is not done for amusement, but that the grain or nap, as it were, of the metal shall be in the direction of its fibre and wear, and shall not be so liable to cut packing glands, etc., and shall be, to some extent, anti-friction. But it takes less to score or corduroy a piston rod with a draw-filed surface, than with a highly polished surface. This is important, aside from its being more nearly anti-friction.

A highly polished rod looks a little streaked at first, owing to the change of light and shade in the polished surface, but that will soon disappear and be all right.

In laboring with your men to accomplish the proper degree of polish, the chances are you will not succeed on the first job; but keep cool, and the next will be better, and, if your men are sensible fellows, they will soon demonstrate, to your gratification, that they have learned a new branch of their trade, and thereafter your drawings will designate just where polish must be had and just where finish comes in.

I have, for a long time, adopted the letter *P*, for polish, and *F*, for finish, both in red ink. We all have our different ideas, but the man who has had the most extended experience usually collects a lot of practical "wrinkles" that are something more than notions.

When we specify polish on different materials, such as wood, brass, bronze, hard and soft cast iron, wrought iron, and hard and soft steel, the foreman should be a judge of what ought to be done, to fulfill the specifications in the best possible manner. It is not presumed that each of these different materials can be manipulated for polishing in the same manner, neither can the same material be manipulated to advantage in the same manner at all times. This is for the reason that, in some instances, a piece may require to be brought to a standard gauge, and still have a polish, in which case, I believe it better to proceed differently from the ordinary method.

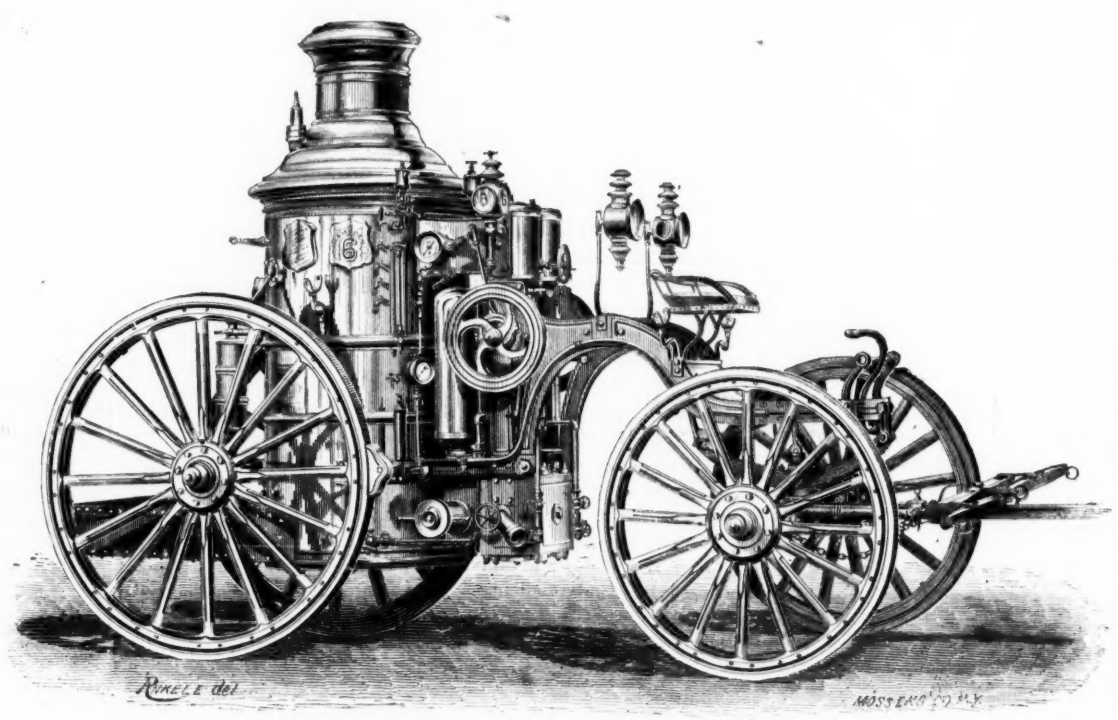
I have said so much about the polish, and its claim on our attention, as critical mechanics, that I have not the time, nor, possibly, you the space, to enter at length into different modes of accomplishing it on different materials.

I judge, however, that Mr. Blackwell gives his method for polishing wrought iron and steel only, and that it is a very good one. He should use pure lard oil, however, in preference to any other for the work.

This filing up the work to get ready for emery cloth and pine clamps is all right for a large amount of detail, but there are times when filing will not do, especially on large pieces.

There is one method which I have used with success for large work. The same principle is right for smaller parts, except it is tedious when applied to a few pieces. A special tool can easily be made—say for steel rods or pistons, it being necessary to bring them to standard gauge, not approximately, but absolutely. There may, possibly, be hard spots running through the steel, that will shed a file, as a hidden nail in a pine stick will shed a draw-knife. My plan is, to employ a properly made and ground tool, to bring the surface of the rod down to a degree of smoothness just right for the wood clamps. For this purpose, emery flour should be mixed with pure lard, not lard oil. At times, I prefer the wood clamps lined with a piece of leather belting, the undressed side out. The finish should be without oil or lard.

The tool I use for this purpose resembles, somewhat, a brass finishing tool, only much heavier. Grind off the leading side to an angle, say 45°, and the face ground on the slightest curve imaginable, with no sharp corner left to drag and leave its mark. The



Improved Crane Neck Steam Fire Engine.

top of tool should be ground off pitching, so that when set its surface shall point a little below the center of the rod, with the tool above. This is preferable to setting an ordinary tool down below the center. Set the tool post well up to its work, for no spring must be permitted now. Run the work rather fast, with a slow feed, if your lathe will stand it and do good work, but if it can't slow down.

This properly accomplished, we shall not require the file, and the work will be uniform in size, and will stand the vernier.

I once examined a piston rod that was so highly polished that at first I could easily believe it was heavily nickel plated and most beautifully buffed, but it was not. Probably it is running to-day as smooth and bright as ever.

I cannot close this article without first saying a word on the grindstone question, for it is an important factor in all shops, and especially where you are working with the vernier in your hand, and a good critical foreman at your elbow. The latter, by the way, is the man we want to talk to about his miserable grindstone, that is covered with grooves and gouges, with one ugly round corner, and as greasy as soap and as hard as lightning all over, or in spots. What has caused it to get so awfully cut off round, that it makes you groan whenever you look at the water and mud and mud and water all about it?

It is a stubborn fact that the grindstones furnished to a large majority of shops are nothing but *grindstones* in more senses than one, and far from being *sandstone tool dressers*.

Now there are a great variety of grades in sandstone, from the quartzite to the friable sand, depending upon the amount of metamorphic action it has been subjected to, and no shop should be cursed by a stone too hard or too soft, especially one combining both of these qualities at once.

The suggestion I desire to make is this: that not only should the stone be placed where one can get all around it freely with belts out of the way, but it should have a good light. A still better plan would be to have two stones hung in the same tub, one a *coarse* grain, the other *fine*, and lastly have them kept in perfect order, and that, too, without permitting the *whole shop*, or *any part* of it, to be filled with sandstone dust when dressing. All this work can be done well at a very slight expense indeed.

Respectfully,
O. C. WOOLSON.

Newark, N. J., Sept. 9, 1880.

ADHESION OF BELTS.

Editor American Machinist:

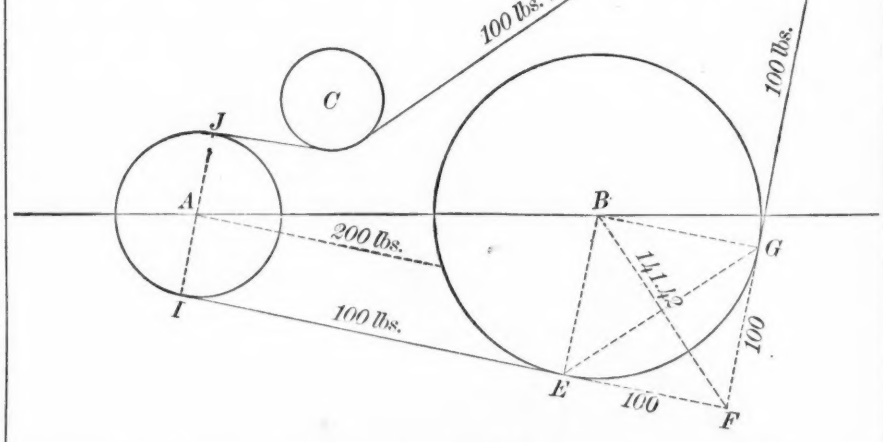
The recent belt controversy in your paper has shown a wonderful variety of opinions regarding the adhesion of belts to pulleys. It has brought to the front the advocates of the theory of atmospheric pressure, as a factor, and the people who believe in atmospheric repulsion. With some of your correspondents, increased surface, without other change of conditions, is believed to give greater adhesion, and very likely as many honestly believe that surface has no more to do with the friction of a belt than with any other rubbing surfaces. Numerous letters have been written and replied to, and there still seems to be as "many minds."

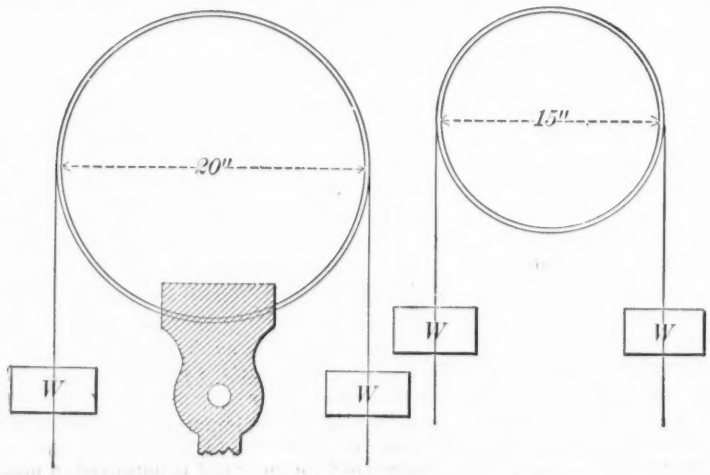
Mr. Cooper's experiments with belts, in atmosphere and vacuum, establish the fact that the influence of air upon a belt is simply nothing. On the other hand, a correspondent of the *Boston Journal of Commerce* recently had an experience that proved to him it was only necessary to drill numerous small holes in the face of a pulley to "let the air out,' to prevent the belt slipping. The discovery was made in this way: There had been considerable trouble, caused by the slipping of a belt, and the pulley was taken down and holes, ¼ inch in diameter, drilled through its face, 2½ inches apart, with a view to riveting on leather. There was not time enough to finish the job, and the pulley was put back on the shaft after drilling the holes, and the belt ceased to slip. The explanation given was, that the holes let the air through, and the belt came in contact with the pulley. Most mechanics would account for the non-slipping of the belt, on the supposition that if it were tightly drawn it would bed itself in the holes. And holes drilled half way through the pulley rim would have given the same results.

An engineer, for whose opinion all men have a profound respect, once said to me, "There is nothing like a simple experiment for confounding a questionable theory."

A few days ago I made some experiments of a simple nature, with a piece of belt and pulleys of different sizes. On large pulleys the results were what most people familiar with belts would expect; on small pulleys quite the reverse. Herewith I give sketch of the method. Any one who can get a short piece of soft, flexible belt, that will readily adjust itself through the circle of the pulley, and two pulleys of different diameters, may satisfy himself in half an hour just what influence surface has on the adhesion of a belt.

A 20-inch pulley was put in a vise, and a piece of 2½-inch belt thrown over its face as shown in sketch. Equal weights were attached to each end of belt to give it pressure to the pulley; then small weights were added to one side until the excess of weight was sufficient to slip the belt. The weights were so closely adjusted that the least change in the way of adding to would give the belt greater velocity, and in taking from would prevent its slipping.





Without disturbing the weights, the belt was then carefully laid across a 15-inch pulley with face exactly like that of the 20-inch, and the results seemed to be precisely the same. The belt was next reduced to 2 inches, by letting ½ inch overlap the edge of the pulley with apparently no change in the tendency to slip. The next day a 2 inch belt was used on smaller pulleys, and the extent of slip carefully timed. A cone pulley was used, and it was very easy to transfer the belt from one size to another, without disturbing the conditions that influenced the friction.

Diameter of 1st pulley.....	12⅛ inches
Distance of slips in one minute....	1¼ "
Diameter of 2nd pulley.....	9⅛ "
Distance of slip in one minute.....	2⅝ "
Diameter of 3d pulley.....	7⅛ "
Distance of slip in one minute	4 "

While there was a regular ratio in the decrease of the size of pulleys there seems to be none to correspond in the slips of belt. Can some of your correspondents who have a turn for investigation, and the time to spare, give any light?

Corning, N. Y. H. TABOR.

SLIPPING OF BELTS.

Editor American Machinist:

Mr. Halsey ventures "to predict," in the MACHINIST of Sept. 11th, that "the belt will have a tendency to slip on *B*," of his diagram.

Every mechanic of considerable experience knows it will slip; knows he has had difficulty in making the pulley go, under such conditions, if any considerable amount of work is to be done, and, especially, if the pulley must run fast. Now, one reason is that the belt does not hug the pulley *B*, with the same pressure per square inch as it does the smaller pulley *A*. For, if the tension on the belt is 100 lbs., then the hug on pulley *A*, will be 200 lbs., whence, it will only be 141.42 lbs. on pulley *B*. If we construct a "parallelogram of forces," we will prolong the line of belt from *E* to *F*, and *G* to *F*, which, in this case, are parallel with, and equal to the radii *B G* and *B E*, then the diagonal *F B* will be in proportion to the resulting pressure on pulley *B*, which is 141.42 lbs., as above. Very truly yours,

A. M. SWAIN.

North Chelmsford, Mass.

Skilled mechanics are scarce in Toronto. A London plumber visited the Queen City a few days ago in order to engage ten men, but could not find one out of employment. —*Toronto National.*

It is expected that the earnings of the Pennsylvania railroad, this fiscal year, will reach $40,000,000, and that the actual net earnings will be at the rate of more than 20 per cent. on the capital stock.

According to recent advices from Berlin, the German government, in deference to a strongly developed public opinion, is about to assume the exclusive ownership of the entire railroad system of the empire. There is also a tendency towards adopting the same policy in France.

Method of Testing Boilers.

Exhaustive trials of engines and boilers are to be made at the approaching exhibition at Dusseldorf, Germany. The method of testing boilers is thus described by *Engineering*:

Each boiler experiment lasts eight hours, and eight of the exhibited boilers are, according to present arrangements, to be tested. The fire having been lit, the steam pressure is raised to five atmospheres, the water level in the glass noted, and the whole contents of the grate withdrawn, merely a handful of live coal being left to light up with. The experiment then begins, all the coal put on the grate being weighed, while at the end the fire is again drawn as before, and the cinders and ashes weighed off separately. The feeding of the fire is done, as we have said, by a stoker provided by the boiler-maker, but with the condition not only that the firing be as uniform as possible, but that during both the first and the last half hours at least as much fuel shall be put on the grate as the average (per half hour) during the whole trial.

The steam pressure is kept as nearly constant, at five atmospheres, as possible. The water level is also kept nearly constant during the trial, but the feeding takes place intermittently and not continuously. The feed water is taken from a large brick tank, and its quantity is carefully weighed, the weight being doubly checked by the following arrangement: in the tank is a float, controlling the position of a hanging pointer, working close against a scale. By previous determination it has been found to what quantities of water in the tank different positions of the pointer correspond, so that the pointer-reading forms one check on the quantity of water. For a second, but rougher check, the number of strokes made by the feed pump is recorded by a counter. The actual measurement is made by filling up the tank to its original level, after the end of the experiment, with water weighed through a large cylindrical vessel placed at hand upon a powerful and accurate weighing machine, sufficiently delicate to turn at 10 grammes. This operation takes place after the water in the glass has been brought to its original level as nearly as possible. The temperature of the feed water is noted every half hour.

The same fuel is used for all the tested boilers, the coal being weighed, as required, upon a machine standing in front of the boiler. Observations of the gauge pressure and also of the steam temperature are made at intervals, and also observations of the temperature of the escaping gases, portions of which it is intended also to analyze. Systematic arrangements are also made for the determination of the amount of water contained in the steam. A certain amount of Glauber salts is dissolved in the water used for feeding the boiler. Every half hour a small quantity of water is withdrawn from the boiler (through the gauge cock). The whole of the quantities so drawn off are put in one bottle, and the percentage of Glauber salts afterwards found in this water is taken to represent the average percentage in the boiler. Each time that water is so removed, steam is also taken away by making a connection with a coil of pipe placed in a vessel of water. The coil has sufficient surface to condense completely the steam passing through it, which is therefore drawn off as water from the bottom of the coil. About a quarter of a litre of this condensed steam is taken each time, and in this way fifteen or sixteen such portions of steam are put together. The amount of Glauber salts (if any) in this condensed steam is determined by analysis, and it is then a mere rule-of-three sum to say how much water must have been carried over with the steam.

A liquid fuel for steamships and locomotives is attracting the attention of engineers in Europe and Asia. It has been tried with complete success on the fastest Russian mail boat on the Caspian Sea, and is to be adopted on the locomotives of various Asiatic lines. The fluid is simply the refuse of petroleum oil, which is carried in an iron tank and blown into spray inside the furnace by a jet of steam, where it burns with a roaring sheet of flame. Such a means of communication requires no stoking, and the flame can be manipulated like a jet of gas, and the steam pressure is easily regulated and kept constant. Moreover, there are no ashes, and the smoke is free from sulphur.

"Honest Western butter" is said to be adulterated with powdered soapstone, which increases the weight of the oleaginous, and the heavy-weight medium cannot be detected by taste.

Polishing in the Lathe.

BY EDGAR PENNEY.

Chordal asks some one to tell how the fine finish is secured that he and others notice and so much admire on certain Eastern tools and steam engines. So far as I am able to describe, I am glad to respond to such an invitation, although I will fall far short of writing a treatise on the subject.

The smaller class of lathe work, after being blocked out with the lathe tool, is generally finished smoothly with a hand scraper, assisted, if need be, by hand tools to correct the outline, if complicated. The piece is then taken to a "speed lathe" and polished in the usual manner with emery and oil applied with a pine stick, sometimes completing the job and putting on a little extra shine by applying crocus cloth by hand. The "speed lathe" is nothing more nor less than a hand lathe fitted with handy rests, and running at a speed of from 200 to 800 revolutions per minute, or even higher, according to the size or diameter of the work being operated upon. In many Eastern shops one or more men are constantly employed at these lathes to do the polishing, the regular lathesmen being responsible for leaving the work in good shape by use of the scraper to receive the final polish, and getting entirely rid of this dirty work.

LARGER LATHE WORK,

such as cylinder heads, false covers, etc., is carefully turned so as not to tear up the grain, and smoothly finished with the hand-scraper, after which it is taken from the lathe and sent to the "stoning" bench. Here a laborer or a bright youth scours the surface uniformly, first with an emery brick, finishing the process with a Turkey or other free-cutting stone, using plenty of kerosene, which is much better than common lubricating oil for the purpose. After all the tool marks and scratches are obliterated, the work is returned to the lathe, and polished with emery and crocus cloth. This finish is a peculiar one, and if by any mishap it should become necessary to repolish a portion that has become scratched or dulled, you may work never so carefully and patiently to bring it back without showing where the texture has been disturbed, but without success; better take it back to the stoning bench, break up the finish by re-stoning, and then polish as before.

In outside curved or ogee work, as covers, etc., it is usual to rough the work and scrape it as near as possible to correct outlines, remove the work from the lathe and file by hand, crossing and recrossing and draw-filing, returning to the lathe as often as need be for scraping, until a perfectly smooth outline is secured, free from ridges or inequalities; now then, stone thoroughly and uniformly, using stone of proper shape to conform to outlines operated upon. Finally, when all scratches and tool marks are effaced, finish in the lathe with crocus cloth applied with a pine stick and by hand, at a suitable speed.

PLANED AND FLAT WORK,

after leaving the tools, is carefully subjected to a cross-filing with proper grades of files until the tool marks are worked out, then stoned to take out the file scratches, and put on the polish with crocus or fine emery cloth, working from one fine grade to another, and spending time in proportion to the effect sought after, taking care, of course, to lay the grain in the direction required.

To put an exquisite polish on, for instance, a connecting rod of a steam engine, turn the rod "water cut" as smoothly as possible, then take to the speed lathe and file until the tool marks are worked out, the file being kept clean and lightly handled, crossing and recrossing so as to avoid ridges; after which put the rod upon centers mounted upon a trestle and at a convenient height to work at, then carefully draw-file with super files; then use the Turkey stone and kerosene until all scratches are worked out; after which take a burnishing tool (usually made from a round file, carefully ground and very finely polished) and, keeping the rod moistened with shaving soap and water, pass tediously and thoroughly over every bit of the surface (carefully protecting parts gone over), until the rod is burnished from end to end, always working, of course, in the direction in which you wish the final finish or grain to lie. Keep the burnishing tool perfectly clean and polished by wiping on a piece of leather or alligator skin. After the burnishing take the crocus cloth, and grasping a well-worn piece in the hand, carefully polish the rod. You will now, if done with a degree of judgment and skill, have secured a finish that for brightness and beauty of surface rivals a mirror, and which the uninitiated would swear to be "nickel plated." This last described process with the aid of a burnisher, supplementing the use of the oil stone, is of course used where the finest finish is required.

TO SECURE A FINE FINISH,

we need

First.—Clean iron of fine grain, the brighter and cleaner the better.

Second.—Proper shapes to receive and show off polish.

Third.—The judicious use of hand tools and scraper in lathe work and use of speed lathes.

The Special Columbia Bicycle.

Fourth.—Final finish after preparation and removal of tool marks and scratches, by cross-filing, stoning and burnishing, polishing by fine crocus cloth.

Fifth.—Plenty of patience, some good judgment and lots of elbow grease. Bear in mind that polishing metals composed of ordinary bulky machine parts, when performed by hand processes, as explained above, doesn't grow of itself, but, at the best, costs considerable; the greatest economy is attained by experience and division of labor, the ordinary polishing and all the stoning being done by unskilled labor, or, rather by men that have learned to do nothing else.

A good practice usually followed in shops noted for their first-class finish, is to put your machine or engine all together with the least possible final finish upon any of the parts, in fact, as the work comes from the tools, when found correct dismantle and finish, and polish the parts required, protecting them with slush and putting at once into papers, and packing ready for shipment. In this way your work will have a clean bright crisp appearance upon erection, the corners being sharp and clearly defined, &c.

I hope that I may have shed a little light upon the way in which some shops secure "that fine nickle plated finish."

Iron is fast becoming one of the important productions of the South. Georgia now produces 100,000 tons of pig iron per annum.

The Special Columbia Bicycle.

One of the most healthful and pleasant exercises a person of sedentary habits can adopt is bicycling. This kind of exercise has become so popular, that several journals are published in England and the United States specially devoted to bicycling matters. The illustration on this page represents the special Columbia bicycle, which embodies the latest and most desirable improvements in this class of sporting vehicles.

The head of this machine is of a modified Stanley pattern, solid steel forging, including the lugs for the handle-bar, and open enough at the back to admit of wide play of the neck of the perch, which is held in it by cone centers, the upper one being on a movable bolt adjusted and held firmly in the top of the head by a small set screw, which also holds the handle-bar. The front fork is solid, having at the lower ends adjustable anti friction ball bearings for the front wheel. The front wheel has substantially spokes for niches, of fine steel wire, held in hubs, which are large in diameter, by slender and neat nipples and lock-nuts. It has a rim, and is very light and graceful in appearance, while, at the same time, it is very firm, and apparently able to withstand any tendency to buckle. The cranks are five and one-half inches in length, detachable and solid, and the pedals are of peculiar and novel construction. These have cone bearings on the crank pin, the fixed cone being at the outer end, and the adjustable one at the inner end, which, when adjusted, is held in the crank slot, and can never bind by coming loose. The pedal is a little shorter, intended to fit the sole of the rider's boot pretty nearly. The bars are nearer together, and the outer end is improved in neatness by the use of a sunken-screw arrangement for fastening, instead of a nut, while there is an oil hole in the center of the pedal shaft, under the dust-cap.

The rear wheel bearing is constructed with two movable cones, one being adjustable, and with neat and close dust-caps, the whole bearing being capable of adjustment without removing the dust-cap, by turning one nut; and the rear wheel is removable without springing its cock. The spring has a long curve, is carried forward to the spindle and bolted through the neck of the perch, and is extended to a good length backward to a slide or fixed clip. Red Para rubber tires and large Siam buffalo-horn handles are used on this machine, and, with the exception of the tire, the handles, and the lever brake, which is of tough iron, every part of the machine is of steel, and every bearing part is case hardened.

Although there are no hollow parts or other apparent efforts at lightness, the parts of the machine are so finely proportioned, and waste material has been so well reduced, that it is very light in weight, a fifty-four inch machine weighing about forty-one pounds.

This new bicycle is manufactured by the Pope M'f'g Co., No. 47 Summer St., Boston, Mass.

Manufacturing Notes.

A company has been organized to establish and operate a large foundry on Van Schaick's island, opposite Cohoes, N. Y.

An exhibition of machinery, tools, mechanical and workshop appliances will be held at the Agricultural Hall, London, England, November 15 to 20 inclusive. Exhibits will be received from November 11 to 15.

The Mower and Reaper Works, of Aultman, Miller & Co., in Akron and Canton, O., are using 100,000 pieces of shafting annually.

A silk mill is being erected at Hawley, Pa., which will have a ground floor of over an acre, be several stories in height and give employment to 1,000 hands.

New England Table Food Association, Boston, Mass., has been incorporated with Edwin A. Eaton, President, Henry G. Hubon, Treasurer. Capital, $250,000, in shares of $100 dollars each. For the manufacture and sale of articles of prepared food, particularly those made under the processes and inventions of Geo. W. Martin, for the conversion of rhubarb into articles of food, medicine, etc.

Vineland, N. J., meditates manufacturing glucose from sweet potatoes.

There is talk of establishing another large iron foundry at Grand Crossing, provided a suitable donation of land can be obtained. In case the foundry is not located at this point it will likely go to Englewood.—*Chicago Industrial World.*

McIntyre & Ward have started the manufacture of emery wheels in Chicago, at No. 80 Market St.

Commercial Mfg. Co., Boston, Mass., has been incorporated with John H. Blodgett Pres., Reuben W. Reed, Treas. Capital, $300,000, in shares of $100 each. For the treatment of animal fats, the production of oleomargarine oil, the manufacture of butter, cheese, stearine, candles, glycerine and all other products that can be obtained from animal fats.

The Worcester (Mass.) Machine Screw Co., are employing about 65 hands in their new and commodious shop, and by the aid of special automatic machinery, designed by the manager, Mr. A. W. Gifford, are enabled to keep up to their orders.

The Whittier Machine Co., 1176 Tremont St., Boston, are crowded with orders for engines and boilers (the latter mostly of steel). They have orders booked for (not "looked for" as a typographical blunder made it in a late issue) two months to come in the boiler department. They also have a number of elevators in course of construction, for different parts of the country.

The Porter-Allen Engine Works, Philadelphia, have nearly completed the 100 horse-power high speed engine for Edison's works at Menlo Park. It is to make 600 revolutions per minute and furnish power to keep 800 electric lamps aglow.

A. French & Co., of Pittsburgh, manufacturers of elliptic springs, are erecting a 245×65 foot extension to their works on Liberty street, the present works being 265×60 feet. By the completion of this extension they will have the largest elliptic spring manufacturing establishment in the world. The machinery, which is all of the most improved patterns, has been ordered, and it is expected that the new works will be in full operation by January 1st, 1881.

The engine and boiler works of the Lane & Bodley Company, Cincinnati, besides filling many orders for engines and other machinery, are working upon a 45 horse-power engine, to be employed at the Cincinnati Exposition.

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The American Institute Fair.

The forty-ninth annual exhibition of the American Institute is now open in this city, and it may be remarked that this institution is the oldest one of the kind in the country. It is, in fact, the only one that has for many years given annual industrial exhibitions. Being a wealthy and incorporated institution, it has abundant means and facilities at its command, to make its exhibitions superior to anything of the kind that can be produced elsewhere in the country. These exhibitions, being the only ones of their kind held in New York city, attract thousands of people from the surrounding country, as well as from the city. Notwithstanding the large means at the command of the managers, for several years past there has been a marked decline in the practical value of these exhibitions.

A few days after the opening of the present exhibition we took occasion to visit it. Although the managers claim to have applications for more space than is contained in the building, the area is scarcely two-thirds filled. The managers state that they are not to blame for the delay in getting exhibitors to fill the space allotted to them, and that the public ought not to blame the management for such delays. This is partly true; but, is not the management of the Fair responsible for not devising some system by which these difficulties may be successfully met? When the Fair opens it is not definitely known how long it will remain open, or, in other words, there is no time set for closing. The duration of the exhibition is too great. In regard to space, exhibitors might be required to occupy their space before the opening day, under penalty of losing it, so as to be ready to start off with a flourish of trumpets at the time appointed.

It is an old opinion among exhibitors, in reference to this Fair, that they are not required to occupy their space until about two weeks after the Fair has opened. At the time of our visit the division known as "machinery hall," was lumbered up with tackles, blocking, and parts of machinery, some unpacked. We noticed a fine large stationary engine, 20″×48″ which will develop upwards of 150 horse power, standing upon a very light brick foundation. The piers, we were told, extended only a short distance below the surface of the ground, resting upon a loose timber bottom. The bed plate rested upon soft pine blocks, placed between it and the bricks, the blocks having open spaces between them. The outboard pillow block rested upon a slim foundation of bricks, capped with soft wood placed under the bearing.

In the first place, an engine of such large dimensions should not have been admitted, as there is no load for it in the Fair, and there is not likely to be. Another engine, 12″×24″, which now drives the machinery, is amply sufficient for the duty required.

The foundations under the engines are entirely insufficient for heavy machinery, and answer to the description given in our columns, a short time since, under the head of Improper Steam Engine Tests.

We have known few cases during the past few years, in these exhibitions, where engines have been set in such a substantial manner that they did not require constant attention, the pillow-block bearings having to be run loose to avoid being destroyed. This was all owing to the instability of the foundations, which were subjected to constant vibrations so long as the engines were in motion.

We understood from the man sent to take charge of the large engine that the managers of the Fair were to furnish help to set the engine, also bearing the expense of the foundations. Some of the parties in charge of the Fair state that the manufacturers must bear the expense of putting up their own machinery. Which of these is true we do not pretend to say, but we do know that a gang of men, hired by the management of the Fair and under the charge of their engineer, was at work upon the large engine putting the machinery together. The help is of an inferior quality and entirely inadequate for the occasion. The man in charge of the boilers, when we interviewed him, did not seem to know anything about a steam boiler—at all events, he knew nothing about steam or its practical working. We were informed that there was an individual employed in the building who had an engineer's license, but he was not in charge of the boilers. There were many patent devices attached to the boiler, but they could not be explained by the man in charge of them. In the main building there are two lines of shafting, one running across the end and the other along the side. Power is transmitted from the line shaft at the end of the building to the other by means of two large V leather belts. Both belts are connected with two grooved pulleys placed upon a vertical shaft, at a convenient distance from both lines of shafting, the latter forming the medium through which the power is transmitted. The belts necessarily have to run at a quarter turn.

We noticed, upon entering the building, that none of the pulleys referred to were in line, and that the belts were quite slack. We called the attention of some of the men in charge of the machinery to the fact, and predicted that unless remedied at once the belt would soon come off, and possibly do some damage. Our admonitions were rejected as groundless, and in less than an hour we heard a crash, and, upon repairing to the place, found one of the belts off the pulley, tearing itself to pieces. After some delay, the engine was stopped and the belt tied up, and no attempt made to put it on again during the evening.

We suggested that a skilled mechanic be procured to place the pulleys in proper position. It was singular that the counter shaft was not pulled down, and the only reason we can give for its not being so treated is, that the timbers were extremely heavy, and the shaft hung in a very clumsy manner. This is one of those cases where a bungling job was probably the means of saving life and broken bones, as there was a crowd of people almost directly beneath the shaft at the time of the accident.

People sometimes get the idea that, when a thing is only for exhibition for a month or six weeks, it may be displayed in a careless manner, and this seems to have been the case in putting up the shafting at the Fair.

It is to be regretted that under circumstances where the managers have every facility at their command, they do not lay aside some of their old fogy notions; get out of the old ruts, and raise the standard of their exhibitions, so that a certificate given under their auspices may be of practical value to the recipients as well as themselves.

The price of admission is still fifty cents. The war closed years ago, wages and prices have fallen, but there is still no change in the prices of tickets. If a person wishes to procure ten admissions, he can get them for $2.50, but mechanics and many persons in moderate circumstances cannot afford to attend more than once or twice during the season. The price of admission should be reduced to twenty-five cents, which is enough. The increased number of admissions and other advantages, to be gained by such a course, should enable the management to maintain their revenue.

The music furnished is very good, but the exhibits are much the same as in previous years.

The young lady who invites visitors to indulge in the luxury of a prepared seidlitz powder for five cents, still exercises her persuasive powers. The cider mill still grinds out its liquid grist, which is dispensed at five cents a glass to thirsty visitors. Most of the catch-penny arrangements, which have held too prominent sway in previous years, have not yet made their appearance. It is to be hoped that they will not be permitted to crowd out more instructive exhibits.

The machine tool business in Worcester was never in a more flourishing condition since the war than it is just now. The complaint is to get enough shop room and skilled machinists.

Boston's 250th Anniversary.

The celebration of its 250th birthday by a great city is an event which has occurred but once in the history of the United States—the time being the 17th of September, and the place, Boston. Upon that day of the year 1630, at a meeting of the Court of Assistants, it was ordered that Trimountain (as it was then designated) should thereafter be called Boston. Its original area was 783 acres, which has gradually been extended until the city now embraces 23,661 acres. Yet this enlargement of territory but faintly indicates the substantial growth of the city in wealth and population, or in her wonderful progress in arts and industries. Boston in 1822, when it became a city, had 49,291 inhabitants. The census of 1880 places the population at 363,565. The present valuation of the city in real and personal property is, in round numbers, six hundred and thirteen million dollars, being an increase of twenty-five and a quarter millions since 1879.

In many respects Boston surpasses every other city in the Union. No other can boast of such a large and well-conducted public library, and its general educational facilities are certainly not excelled. There is no parsimony in expending money for public improvements. An example of this is evinced in the construction of sewage works, now in progress, which will cost about eight million dollars.

The celebration of Boston's 250th birthday, like every other grand undertaking depending upon the local pride and public spirit of her citizens, was conducted upon a scale that would be hard to equal elsewhere. The most profuse and tasteful decorations were displayed in every part of the city. It is estimated that over 300,000 visitors were present from other localities. A grand procession, representing the civil, military and industrial interests, moved through the principal streets, requiring three hours and a quarter to pass a given point. In the evening a round of festivities of a refined character was enjoyed. The elasticity of the business men of the city was well shown by the almost complete interruption of business for a day of pleasure, and the equally complete resumption of business next morning.

Our esteemed contemporary, the *Scientific American*, in its issue of September 25th, copies verbatim half a column of our editorial on A Model Foreman, which appeared in the American Machinist of May 22d, with the remark that it "contains not only good advice to the class of persons to whom it is addressed, and to which they will do well to heed, but to the manufacturer it suggests some of the qualifications a foreman should possess to insure harmony and good feeling among the workmen." While expressing our obligations for this compliment we must call the attention of our contemporary to the fact that it (inadvertently of course) gives the credit to another publication, into whose columns the article found its way without any mention of the source from which it was obtained. We trust that, with the candor that usually distinguishes our neighbor, the proper correction will be made.

Then and Now.

In looking over an old file of the *New York Transcript* (a small one cent daily), for May, 1835, we find the following short editorial paragraph:

Trade Strike.—A number of the Journeymen Stone Cutters turned out yesterday for higher wages. They do right, as do all other mechanics, to insist upon a liberal compensation for their labor, especially at a time when such exorbitant prices for rent and provisions are demanded.

The date of the paper containing the above is May 7, 1835, and upon the same page, under the heading *Late and Important from Europe*, appears news from Paris to the 10th of April, from Havre to the 11th of April, and from London to April 7th, or just one month previous. It is well to give a passing thought to the wonderful progress that has been made since then—forty-five

years ago. The electric telegraph has sprung into existence and the Atlantic has been spanned by a cable, over which is flashed in a moment the news of immediate happenings, as though the two continents were separated no further than by our common ferries. The lightning express trains and the lightning printing press are creations of more modern days. The great daily newspaper of to-day not only contains the latest transatlantic news down to the hour of going to press, but gives much fuller and more intelligent accounts of local matters. In 1880, the event which was, in 1835, briefly dismissed in the puny paragraph above quoted, would receive the attention demanded by the march of progress, and would be treated in the morning paper in about the following style and language, with slight variations to suit different occasions :

TROUBLESOME STONE CUTTERS.

A number of uneasy and discontented stonecutters, employed in yards on the West Side, have been conspiring together to bring trouble by endeavoring to get up a strike for higher wages, and inducing their fellow-workmen to join them in that undertaking. Their designs were discovered about a week ago, when some of the boldest of the agitators privately sought interviews with the contractors by whom they are employed, and complained of the insufficiency of their pay in view of the high price of rent and provisions. In vain was it pointed out to these men that they were already paid a higher rate of wages than the average for such work for the past five years, during which time prices of the necessaries of life have declined considerably. They were stubborn and would not accept sound advice. As soon as it became evident that an open rupture would occur, unless the malcontents could carry out their object, a meeting of contractors was called, at which every one was present, either in person or by proxy. Strong resolutions were adopted and signed by all the employers, pledging themselves to unity in resisting the unjust demands of the stonecutters, and to do all in their power to break up the trades unions, which are directly the cause of the mischief. Yesterday the men struck in a body, causing a stoppage of work in all the yards. Their action is severely condemned, especially as this is in the height of the busy season, and all the yards have large contracts to fill. No disturbance has yet taken place, but an extra force of police are on the watch for riotous demonstrations.

An industry that gives the most substantial support to the manufacturers of machinery and machinists' supplies is that of railroading, which has received a wonderful impetus within the last twelve months. Over 3,300 miles of new road have been built this year, which is nearly double the railroad construction for the same portion of 1879, and largely in excess of the mileage laid, in the same period, in any other year since 1872. Besides the numerous short lines and extensions upon which work is in progress, at least two important trunk lines are projected, with a strong probability of their being built in a reasonably short space of time. Locomotive and car shops are full of work and steel rail mills are well supplied with orders. Indications point to even a greater swelling of the railroad boom.

Allen Howard Crosby and others have filed articles in the office of the Secretary of State, Albany, N. Y., incorporating the Dominican and New York Commercial Company, with a capital of $2,000,000. The company is to construct wharves, organize transportation lines, and transact commercial business.

Literary Notes.

NEW TEXT BOOK OF PHYSICS.—An Elementary Course in Natural Philosophy. Designed for use in High Schools and Academies. By LeRoy C. Cooley, Ph. D., Professor of Physics and Chemistry in Vassar College. 317 pages, illustrated. Chas. Scribner's Sons, New York.

Some twelve years ago, a series of text books of Physics, by Prof. Cooley (of which the one on Natural Philosophy was the first) was issued from the same publishing house as the one under present notice. At once systematic, clear and thorough in their treatment of each subject in course, the books comprising the series were well received and have had an extensive sale. The New Text Book of Physics has evidently been prepared to meet the wants of those wishing to acquire, or impart, correct elementary knowledge of physical science, as revealed by late discoveries and applications, as well as by old established principles. The central idea, around which clusters the well-directed thoughts that stand forth in this work, is the principle of energy. "Physics," says the author in his preface, "has come to be universally regarded by scientists as 'the science of matter and energy;' and I have felt that, unless I could fairly present the principle of energy as the most vital element of the system, my work would be altogether out of harmony with the later views, and unworthy to be used in the education of the young, because it would fail to give the student any adequate idea of the present state of the science."

Beginning with *Matter* and *Motion*, the text leads successively, by easy stages, to the fundamental developments of energy in heat, sound, light and electricity, terminating by a chapter on machinery. The telephone, the phonograph, and the microphone, are explained by aid of engravings, better and in fewer words than we have seen this done in any other publication. Everything in the work is presented concisely, and with such logical connection as to be readily understood by the average learner, and not soon forgotten. *Etherial* theories and all matters which, as yet, are only probable (the relating of which constitutes the *stuffing* in many text books of Physics) are carefully omitted, only that which has come to be universally accepted being taken for consideration. Many problems involving the principles discussed are introduced at the close of the chapters.

Although the work is almost altogether original, numerous specific references are made, not only to the book by name, but to the particular paragraph where the information is to be found.

The author, Prof. Cooley, is one of the most signally successful teachers of physical science of whom we have any knowledge. It was our valued privilege, previous to the publication of his first text book, to be one of a class passing through a course of instruction in Physics under his direction.

We will add that the New Text Book of Physics, although designed for a text book for students, is a work that every practical machinist and engineer would do well to possess.

EXPERIMENTS ON THE STRENGTH OF WROUGHT IRON AND OF CHAIN CABLES.—Report of the Committees of the U. S. Board, appointed to test iron, steel, and other metals, on chain cables, malleable iron, and reheating and rerolling wrought iron. By Commander L. A. Beardslee, U. S. N., Member of the Board and Chairman of the Committees. Revised and abridged by William Kent, M.E., formerly assistant to the Committees on Alloys, of the U. S. Board. 8vo. cloth, 120 pp. Price, $2. Published by John Wiley & Sons, New York.

This book is composed of an abridgement from the Government report, published in 1879, of which there were a limtied number issued. On account of the valuable nature of the contents and the general practical value, it was thought advisable to publish detached portions of the report referred to, classifying each subject properly to avoid any complications which might arise. The tests, of which a tabulated report is given in this book, are probably the most exhaustive that were ever made, and are, necessarily, of great value. The molecular and other physical changes, which take place in the different metals while subjected to a test, are fully described, and are not only very interesting, but are of great practical value to the engineer and manufacturer. The book is illustrated; the frontispiece being produced by the heliotype process, which shows the fracture of a bar or link in a chain very correctly. The book is nicely printed in clear type and is very easy to read. The fact that the work was revised by Mr. Kent, who conducted a large portion of the experiments, should insure for it a large and well-appreciated circulation.

Questions and Answers.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly and according to common sense methods.

(1.) W. K. H., Newport, Del., asks: What is the weight of a gallon of water 231 cubic inches? *A.*—Your inquiry is rather indefinite, as you do not state the kind of water or the temperature. For instance, the weight of a cubic foot of fresh water at a temperature of 40° Fah. is 62.408 lbs., while at a temperature of 300° the weight is 57.42 lbs. From the following data you can probably get what you desire. The weight of a cubic inch of distilled water at 60° Fah. is .036 lbs., or 8.33 lbs. to the gallon. A cubic inch of sea water at 60° Fah. weighs .037 or 8.55 lbs. to the gallon. A cubic inch of pure rain or distilled water at 60° weighs .03607 lbs., or 57,712 oz. avoirdupois. And a pound contains 27.724 cubic inches equal to a cube of 3.0263 inches on each edge. The weight of fresh water is in practice generally assumed as 62⅜ lbs. per cubic foot, yet 62¼ lbs. would be nearer the truth at ordinary temperatures of about 70°, or a pound equals 27.759 cubic inches, and a cubic inch equals .5764 oz. avoirdupois, or .4323 ozs. troy, or 252.175 grains. The grains are the same in avoirdupois, troy, and apothecaries weights.

(2.) H. L. H., Atlanta, Ga., asks: Can you give me any information as to how I may reduce the noise from the exhaust of a compress? The exhaust pipe is of 8 inches diameter, and about 20 feet long. Four feet at the top is tapered, giving an opening of 15 inches diameter. The steam is exhausted from 20 to 100 lbs. pressure. *A.*—The subject of deadening the sound from escaping steam has been the source of much experiment which has resulted in very fair success. The most effective of these devices is a box full of glass beads placed over the mouth of the pipe. The box must be of sufficient capacity to allow the free escape of steam between the beads. Another plan is to place a series of small bent pipes in the sides of the exhaust, and stop up the end, filling the end also with pipes of the same description. Still another plan is to make a large coil of wire or spring which is closely coiled. This is placed between two ends, one of which is screwed upon the end of the exhaust pipe. By tightening or loosening the rods which hold the ends together, the openings between the coils of wire may be varied so as to permit the free or suppressed escape of steam. All these devices are patented, and possess a more or less degree of merit.

(3) J. P. H. L., Grand Crossing, Ill., writes: I noticed in your issue of Aug. 21, 1880, an answer to a question how to galvanize wrought and cast iron, and would inquire: 1. Can you inform me of the best method for tinning tacks and nails? Rattling them with sand after the vitrol bath may be a good idea, but would tend to dull the points. *A.*—To tin small articles of wrought iron or steel: Place them in warm water with a little sulphuric acid added to it which will clean them, then powder some sal-ammoniac and mix it in the water, stirring well until all is dissolved. After washing the articles in clean water place them in the solution for a few minutes, then lay them by the fire to dry. Procure a pan resembling a frying pan in shape, the bottom of which must be full of small holes. The pot for melting the tin must be large enough to admit the pan for holding the articles. Cover the bottom of the pan with the articles to be tinned, and after sprinkling a little powdered sal-ammoniac over the surface of the molten tin to clear it from dross, dip the pan containing the goods into it. After all the smoke has disappeared lift it out and shake well over the pot, sprinkling a little sal-ammoniac over the goods to prevent them from having too thick a coat, then cool quickly in cold water to keep them bright. 2. Why should chloride of zinc be put into a sheet zinc vessel when used? *A.*—To prevent impurities from getting into the solution; as, for instance, when the acid and chloride of zinc is put into a vessel of other metal, and some earthen vessels as well, the chemical action of the acid will extract the lead and other impurities in the substances of which the vessels are composed.

(4) A. J., Wilmington, Del., writes: In the AMERICAN MACHINIST for March, 1879, I read an article entitled Engineering Popularized, by Wm. Lee Church, wherein he gives the formula

$$p \propto v^{-\frac{10}{9}}$$

for calculating the adiabatic curve. Mr. Church also describes the isothermal curve and a method by which it can be produced from a diagram without the use of figures which is an excellent method. I desire to know if there is any means of getting around the formula to which reference has been made and laying out the adiabatic curve exact without the use of complicated formulas. *A.*—An instrument was invented some time since by John Wilkinson, an English engineer, for the purpose desired. It resembles in size and appearance a two foot rule with a single joint. By placing the inner edge of one part of the rule upon the zero line and opening the other part of the rule so that the inner edge bisects the point of cut-off, the points in the adiabatic curve may be readily and accurately laid out, by drawing vertical and parallel lines from the graduations upon the two edges of the instrument. The points where the lines bisect each other, will be the points in the curve. This instrument or scale is described in a treatise on The Theory and Action of the Steam Engine (for practical men) by W. H. Northcott, C. E.

Business Specials.

40 cts. a line for each insertion under this head.

Vertical and Horizontal Pumps. Capacity from 100 to 35,000 galls. per minute. Simple, Efficient, Economical, Durable. Used by more than half the tanners and paper makers of the country. Horizontal and Vertical ENGINES, from 10 to 30 H. P., for long continued hard work. Prices, 40 per cent. below other makers. Send for circulars. Heald, Sisco & Co., Baldwinsville, N. Y.

Howard S. Abbot, Attorney at Law and Solicitor of Patents, 617 7th Street, N. W., Washington, D. C. Patent business of every description attented to.

Alfred Wilkinson, Engineer and Mechanical Draughtsman, can be consulted on all matters connected with the economical use of steam; 506 Walnut Street, Philadelphia. Engines indicated, power measured and valves adjusted for best results.

Thomas D. Stetson, Patent Solicitor and Expert in Patent Cases, No. 23 Murray Street, New York.

Mechanics having a taste for Astronomy can make their own telescope by purchasing a silvered glass speculum, diagonal mirror and eye piece. Will be pleased to furnish the above, of first quality, from 5″ to 15″ diameter at half the cost of imported ones. Will also furnish instructions for mounting them. Address, with stamp, J. A. Brashear, No. 3 Holt St., Pittsburgh S. S., Penna.

Blowers for all purposes. Exeter Machine Works, 50 Federal Street, Boston.

American Watch Tool Co., Waltham, Mass. Lathes, Watch Case, and Clock-Making Machinery.

See Christiana Machine Co.'s adver., next number.

The $4 Drill Chuck, 0 to 9-16. Sent free on receipt of price. Address A. F. Cushman, Hartford, Conn.

Drop Hammers. Stiles & Parker Press Co., Middletown, Conn.

Steam Cylinders bored from 3 to 110 inches. L. B. Flanders Machine Works, Philadelphia, Pa.

Paper Making Machinery—Makers of above from fibrous material as wood, esparto grass, etc., send address to Joshua Rose, P. O. Box 3306, N. Y. City.

Rules for Engineers, and Removal of Scale in Boilers. Send for Circular. Ranken Scale Co., 50 Federal Street, Boston.

Dixon's Traction Belt Grease. Dixon's Founders' Perfect Wash. Dixon's Plumbago Foundry Facing. Dixon's Graphite Machine Grease. Dixon's Everlasting Graphite Axle Grease. Dixon's Dry American Graphite Perfect Lubricator. Send for explanatory circular to Dixon Crucible Co., Jersey City, N. J.

Manual of Power for Machines, Shafts, and Belts, with the History of Cotton Manufacture in the United States, by Samuel Webber, C. E., copyrighted 1879. Only work of the kind extant; 240 pages. Price $3. Address, D. Appleton & Co, New York, or the author, Manchester, N. H.

Sheet Metal Presses. Ferracute Co., Bridgeton, N.J.

Engines Indicated—Power Measured. W. H. Odell, Box 274, Yonkers, N. Y.

John Douglass, common and fine patterns made to order, also car wheels, working models, and experimental machinery. Shop at Washburn, Hunts and Co's Wheel Foundry, cor. Warren and Bay Sts., Jersey City, N. J.

MANUFACTURES.

The Bay State Iron Works, at Erie, Pa., have contracts for 50 engines.

The Deane Steam Pump Works, at Holyoke, Mass., have been twice enlarged during the past year, yet they are pushed to keep up to their orders.

Wm. Sellers & Co., Philadelphia, manufacturers of machinists' tools, have put in a sand blast apparatus for sharpening their files.

The Akron Iron Co., Akron, O., has largely increased the capacity of its rolling mill. The demand for hot polished shafting is increasing rapidly. For strength and accuracy this shafting is giving excellent satisfaction. The machinery is ready in the new building, and an electric light is to be used.

A. F. Towle & Son M'f'g, Co., Newburyport, Mass., has been incorporated with Anthony T. Towle, Pres., Edward B. Towle, Treas., Capital, $20,000 in shares of $100 each. For the manufacture of solid and plated silver ware.

Machinery for the manufacture of wire nails is to be placed in the new works of the St. Louis Wire Mill Company.

David W. Pond, Worcester, Mass., has just built an addition to his machine tool works, which, with certain changes in the arrangement of tools in the old shops, will give thirty per cent. more capacity of production. The addition includes elegantly fitted offices; 200 men are now employed and more first-class machinists are wanted.

P. Blaisdell & Co., Worcester, Mass., are now employing about 75 men in building machines, and could secure many more orders if they had the shop capacity to execute them.

The Hamilton Rivet Works is the name of a new enterprise recently projected in Hamilton, O.

The Edwards Iron Company have just completed and put in blast a new furnace at Woodstock, Ala. It is running on brown hematite ores, mined in the vicinity, with Alabama coke as fuel.

Youngstown, O., is going to add fifty thousand dollars subscription to the hundred thousand already raised for the Anson Wood Mower and Reaper Works to be brought to that city.

Witman's foundry, Ironton, O., is about ready to make a melt. Everything has a prosperous business-look up there.

D. Round, of Newburgh, O., manufacturer of chain of all kinds, has erected a new building 21x75 feet.

A Newark edge-tool manufacturer has shipped 1000 dozen axes and hatchets to Australia.

The St. Louis Stove Works have almost completed an addition to their establishment in the shape of an extensive foundry.

Frick & Co., of the Eclipse Steam and Boiler Works, Waynesboro, Pa., are very busy on engines and sawmills. They have one hundred and sixty-five orders ahead.

A new steel mill is to be located at Pittsburg, by A. Kloman & Son, of the Superior Mill, Allegheny. It will consist of a 21 inch rail train, a 16 inch bar train, a muck train, and two Universal mills for rolling special shapes. Its capacity is estimated at 50,000 tons of steel rails annually, and 30,000 tons of structural material, principally steel.

The Gardner Governor Works, Quincy, Ill., which were almost entirely destroyed by fire on July 28th, were rebuilt and in full operation September 1st. Although now the largest governor works in the world, Mr. Gardner has plans prepared for a new workshop upon which work will be begun at once, and which when completed will have a capacity double that of the present works.—*Age of Steel.*

J. C. Bailey, the Chief Engineer of the Toronto and Ottawa railway, has gone over the whole of the route between the two cities, and estimates the cost of the construction of the line at six millions of dollars.

Machinists' and Engineers' Supplies.

NEW YORK, September 23, 1880.

The supply market continues brisk; most of the dealers are quite busy endeavoring to fill their orders. The only way some dealers can obtain a stock for exhibition, is the receipt of goods for orders which have been countermanded.

Some of the dealers in small tools state that their trade has declined somewhat during the past two weeks, but is still very satisfactory. Values are unchanged.

Iron pipe continues very stiff, but the prices have not advanced.

Messrs. Beckett & McDowell, 17 Cortlandt St., New York, have just issued a new catalogue and circular, illustrating and describing their special class of machinery for mining purposes. A second part is soon to be issued, describing milling and smelting processes for treating ores.

A. Aller, 109 Liberty St., New York, has just issued a new illustrated catalogue describing the practical application and operation of the Korting injectors, steam blowers, gas exhausters, ejectors and other specialties.

Iron Review.

NEW YORK, September 23, 1880.

Pig iron is about as reported last week—no particular activity. We quote as follows: No. 1, foundry, $25 to $26; No. 2, $22, and forge, $20 to $21. Scotch Pig is in fair demand at $21.50 for Eglinton; $24 to $25 for Coltness; $23 to $24 for Glengarnock, and $22.50 to $23.50 for Carnbroe.

Manufactured iron is in steady demand at following prices:

Iron Rails, $50 to $53, according to weight; Fish Plates, 2¼c. per lb.; Railway Spikes, 3¼c.; Bolts and Nuts, 3½c.; Common Bar Iron, 2.4c., basis from store, Refined do. 2.6c., basis; Ulster, 3 6-10c. basis; Machinery Steel, 6½c.; Best Tool Steel, 13½c.; Norway Bar Iron, 6¼c.; Norway Shapes, 6¾c; Nail Rods, 6¾c.; Sheet Iron, 3½c., basis; Angle Iron, 3¼c.; Tee Iron, 3¾c.; Band Iron, 3.4c.; Hoop Iron, 3.6c., and up according to size; Horse Shoe Iron, 3.5c.; Hot Polished Shafting in lengths, 2 ft. and longer, 9 to 10½c., according to size; Small Black Rivets, 30% off in papers; 10% off in bulk.

Carmichael & Emmens, 130 Cedar St., New York, quote prices of Boiler Makers' Supplies from store as follows:

Flange Iron	5¼
C. H., No. 1, Shell Iron	4¼
C. No. 1 Iron	4
Tank Iron	3¾
Sheet Iron	3½
Angle Iron	3½
Bead Iron	5½
Burden Boiler Rivets	5 1-10

Boiler Tubes at 40 per cent. discount off list.

Metal Review.

LUCIUS HART & CO., 8 & 10 Burling Slip, New York, furnish us the following, under date of Sept. 23, 1880:

Business has been confined to jobbing metals during the past week. Pig tin declined in London to £79 (on account of "bear sales" by speculators) and prevented large transactions here. Singapore $26.50c. Stocks Spot and to arrive not excessive and strongly held, demand very good. Would quote Banca tin, 25c.; Malacca and Straits 20c.; Australian, Billiton and refined, English, 19½ to 19¾c.; "Lamb & Flag" 19½c.; Pig Lead, 5½c.; Antimony, 16c. to 17c., as to brand.; Spelter, "Bertha," pure, 8½c.; Silesian, 6c.; Western, 5½c.; No. 1 Solder, 11c.; "Half and Half," 13c.; Bismuth, $2.50 to $3.00.

WANTED.

Foreman wanted for an iron foundry doing all kinds of machine work. To a competent man a good salary and steady employment. Address "Foundry," care of Morse Burtis, 76 John St., New York.

Wanted.—Situation as foreman in machine shop. Have had thirty years experience and used to any class of work. Address, William Fitton, Railroad St., 32d Ward, Mount Washington, Pittsburgh, Pa.

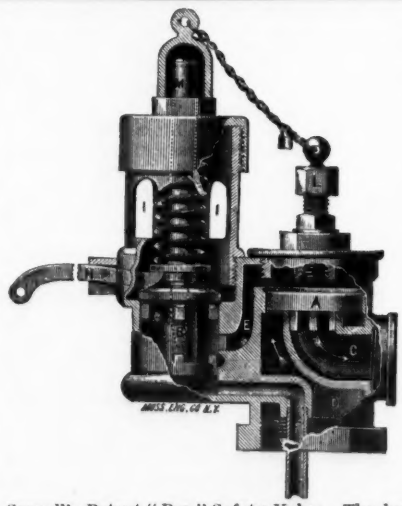
Wanted.—A Superintendent for a foundry and machine works now employing 67 hands. State class of work been accustomed to, and reference fully. Address Geo. R. Lombard & Co., Augusta, Ga.

Wanted.—A reliable second hand Richards Indicator. Address with price and particulars, C. W. N., office AMERICAN MACHINIST.

Second-Hand Machinery for Sale.

Lathe, 8 ft. bed, 22 in. swing, screw cutting, Wood Light & Co's make, $275.
Lathe, 6 ft. bed, 15 inch swing, screw cutting, Lathe & Morse make, $200.
Lathe, 8 ft. bed, 20 inch swing, $100.
Planer, plain 4 ft., 22 in. wide, Lincoln make, $250.
Brown's Bolt and Tap Machine, $50.
Upright Post Drill, $40.
Engines, Boilers and Pumps, new and second-hand, furnished at low figures at

B. STANNARD'S NEW MACHINERY STORE,
533 West 41st Street,
NEW YORK CITY.



Scovell's Patent "Pop" Safety Valve. The best for Stationary, Marine, Portable and Locomotive Boilers. Send for circulars and terms to **The Hancock Inspirator Co.**, 34 Beach St., Boston, Mass.

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24 Columbia Street.
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Maker and Patentee of
IMPROVED HYDRAULIC JACKS,

Punches, and Roller Tube Expanders,
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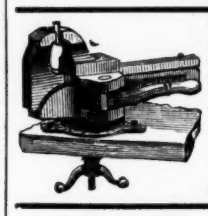
DIRECT ACTING
Steam Hammers.

Communications by letter will receive prompt attention.

Jacks for Pressing on Car Wheels or Crank Pins made to order.

GEO. W. FIFIELD,
Manufacturer of ENGINE LATHES from 16 to 48 in. swing. Cuts, Photographs and Prices furnished on application.
LOWELL, MASS., U. S. A.



STEPHENS' PATENT PARALLEL VISE and attachments, adapted to every variety of work from Jewelers' to Locomotive Shops. It opens **further,** holds **firmer,** is **heavier** and more **durable** than any other vise. For sale by the trade.
Stephens' Patent Vise Co.
41 Dey St., New York, U. S. A.

FOR SALE.

A large and fully equipped
Machine Shop, Foundry and Smith Shop,
with full assortment of patterns, including a full set of Corliss engine patterns from 10 in. to and including 40 in. cylinders, located at Taunton, Mass.
THE GEORGE PLACE MACHINERY AGENCY.
121 Chambers street, New York.

THE Greenfield Vertical Engine,
SOLD BY
WILLIAM COOKE,
(Successor to COOKE & BEGGS,)
6 CORTLANDT STREET, NEW YORK,
IS THE BEST IN THE MARKET.

Send for my prices before ordering Engines, Boilers, or other machinery.

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KEYSTONE INJECTORS,
Etc.

FOR SALE.
2 No. 2 Second-Hand MacKenzie Cupolas.
1 No. 2 " " " Blower.
APPLY TO
KNOWLES STEAM PUMP WORKS,
44 Washington St., Boston.

TO LET.
The whole or part of the finest building in Brooklyn. 75x100 feet, four stories high, and splendid high, dry cellar, with the best of light, only one block from the New York Ferries, on a corner, near the depots of all the main trunk lines of Railroads to the North and West.
The very best chance for a Manufacturing, Printing, or Publishing business near New York. Will be let with or without steam, which can furnish, if required, to 100 Horse Power.
Will be let low to right parties.
Address "BUILDING,"
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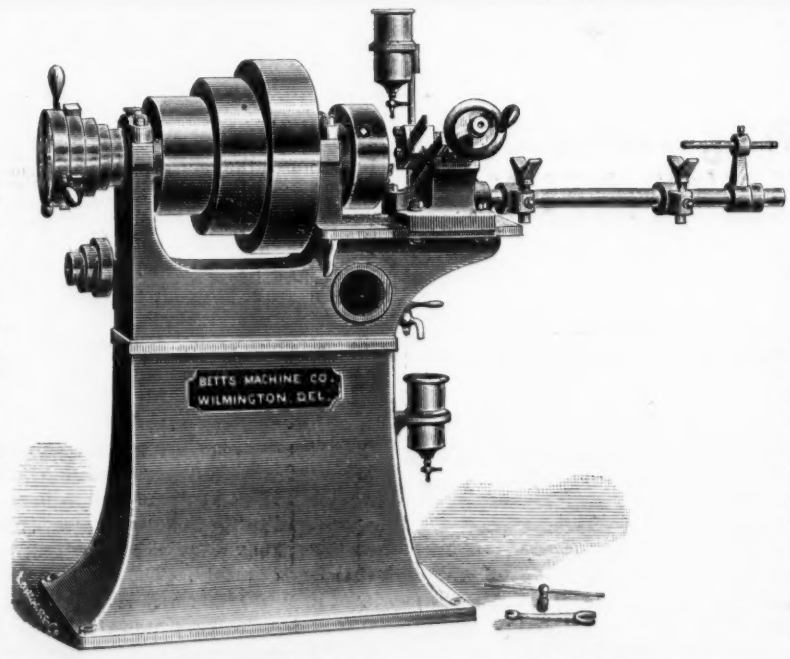
AKRON IRON COMPANY,
AKRON, O.
SOLE MANUFACTURERS OF
Patent Hot Polished Shafting.

This shafting commends itself to the trade generally as superior to any shafting ever before introduced to the market for the following reasons, viz.:

1st.—It is perfectly straight and round.
2d.—It can be rolled accurately to any desired gauge.
3d.—It has the beautiful blue finish of Russia Sheet Iron, rendering it less liable to rust or tarnish than shafting of the ordinary finish.
4th.—It will NOT SPRING OR WARP IN KEY SEATING like most of the other manufactured shafting sold in the market, and, as a consequence, is admirably adapted for LINE AND COUNTER SHAFTING.
5th.—The surface is composed of MAGNETIC OXIDE OF IRON, forming a superior journal or bearing surface.
6th.—It is made of superior stock.

Price lists, with references and other information, furnished on application to us.

AKRON IRON CO., Akron, Ohio.
Or to our Agent,
E. P. BULLARD, 14 Dey Street, New York City,
General Agent for N. Y. City and other Eastern States.



2½ in. Cutting-Off Machine.

Will make 25 Cuts of 2 inch round iron in ONE hour, and leave the ends in FIRST RATE condition.

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NICHOLSON FILE CO.

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HAVING THE INCREMENT CUT.

Also, FILERS' TOOLS and SPECIALTIES.

"Nicholson File Co's" Files and Rasps.
"Double Ender" Saw Files.
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Handled Rifflers.
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File Brushes, File Cards.
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Stub Files and Holders.
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NEWARK STEEL WORKS.

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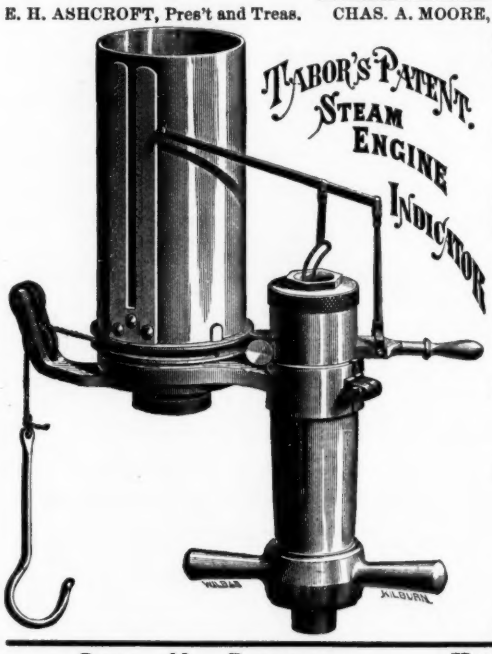

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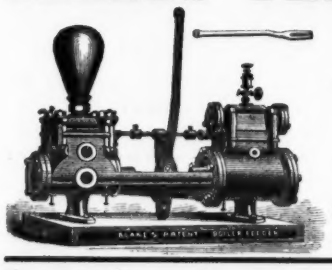

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Office, No. 78 Chambers Street, N. Y. | Full Weight Hand-Cut Files. | Manufactory, PATERSON, N. J.

The best and cheapest in the end. Send for quotations. The files speak for themselves in the following testimonials. Read them.

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We have used the Files made and re-cut by Messrs. WEINMANN & KEARNEY for the past three years, and we know of no better recommendation than the fact that we are still using them.

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We print instructions on the use of Files, and also give the diameters of round and square Files from 3 to 16 inches. They are on card board, 10x12 in., and are intended to be put up in the shop for the men to read. We are pleased to mail them to any manufacturer on receipt of the necessary 6 cents postage.

Respectfully, KEARNEY & FOOT.

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FOR SIMPLICITY OF MECHANISM

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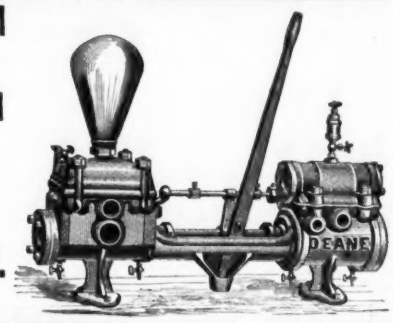

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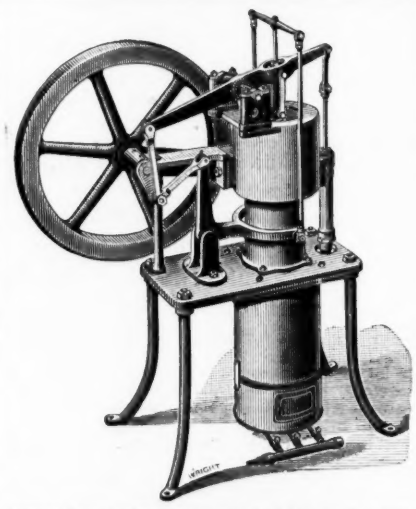

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This pumping engine is entirely safe, no steam being employed, and is not liable to derangement.

All kinds of fuel will answer for this engine, but coal-gas is preferable, the consumption being only 15 cubic feet per hour. Besides gas is handier and cleaner than coal or other combustibles. Servant girl can operate it!

Price for 8-inch cylinder, pumping 350 gallons per hour 50 feet: With gas furnace, - $260 00
With coal furnace, - 275 00

Price for 6-inch cylinder, pumping 200 gallons per hour 50 feet: With gas furnace, - $210 00
With coal furnace, - 220 00

Manufactured by the Delamater Iron Works.

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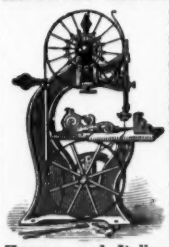

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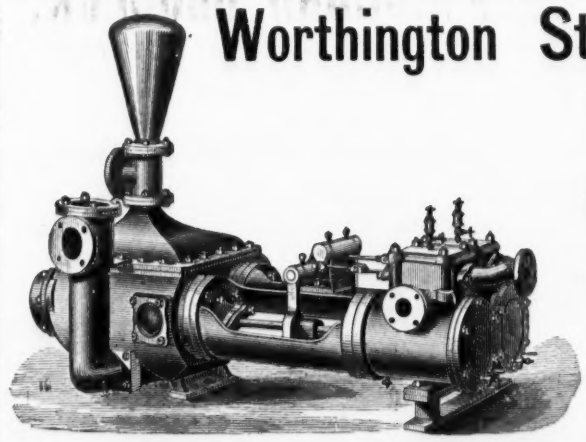

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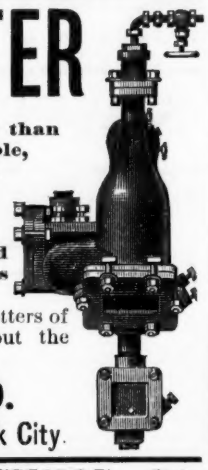

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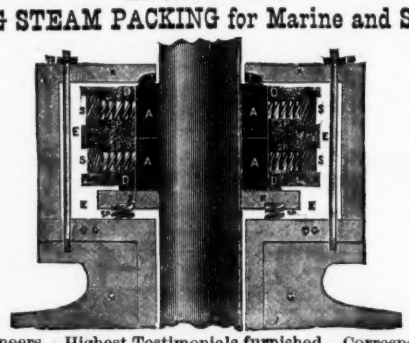

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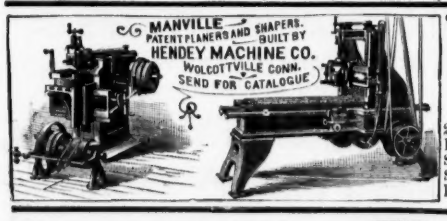

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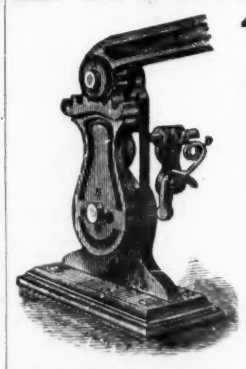

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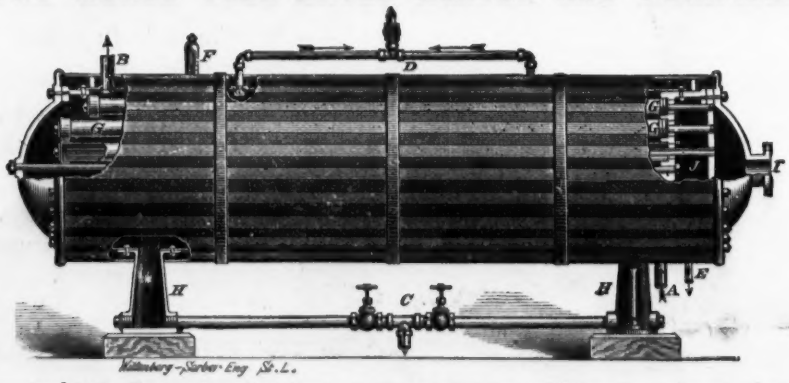

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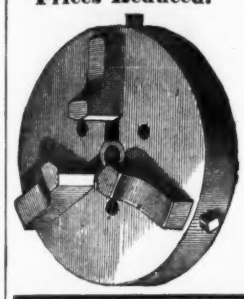

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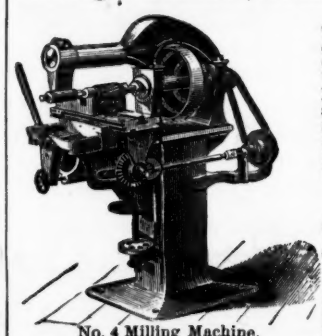

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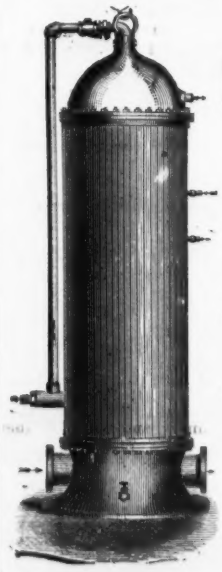

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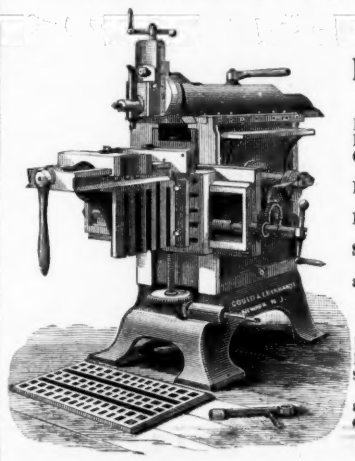

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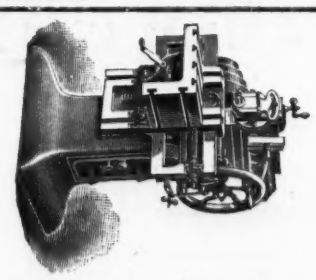

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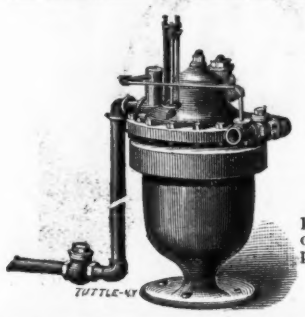

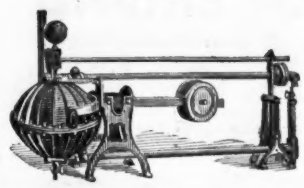

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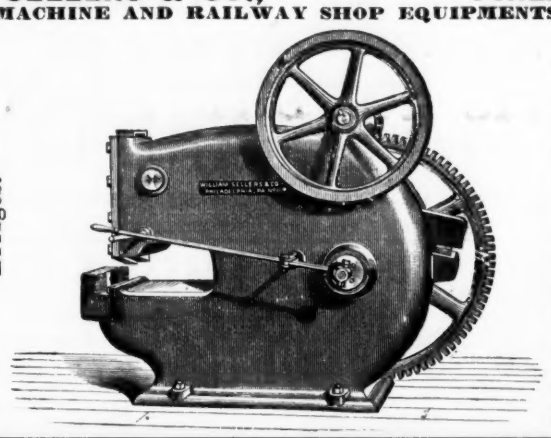

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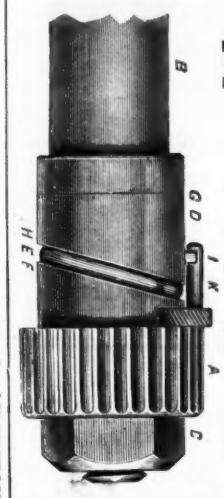

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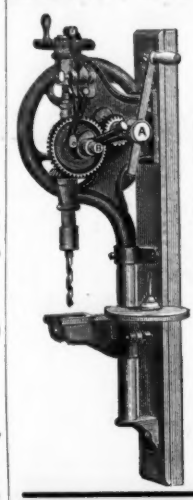

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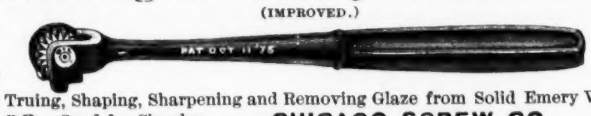

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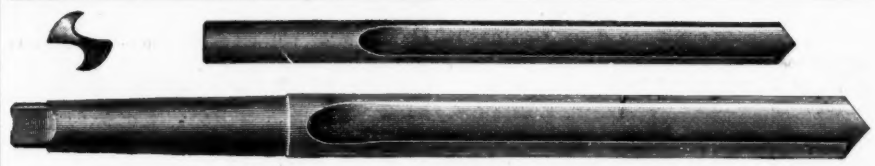

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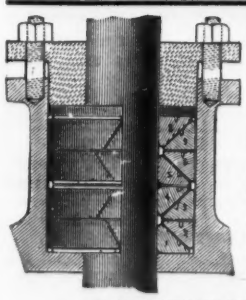

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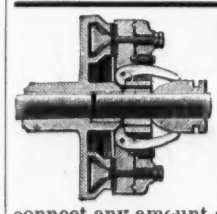

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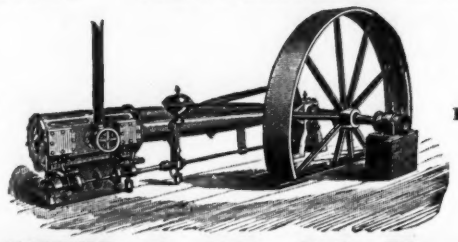

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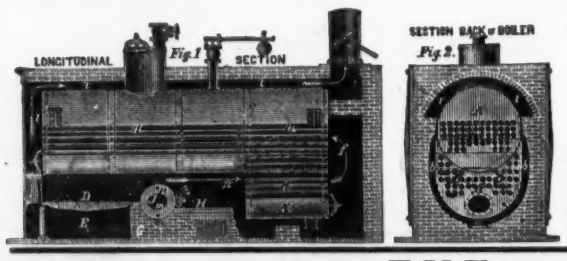

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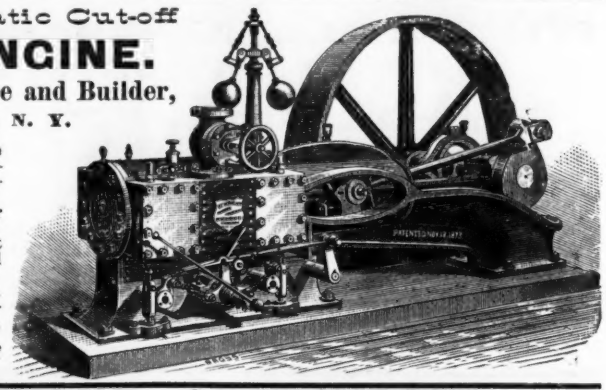

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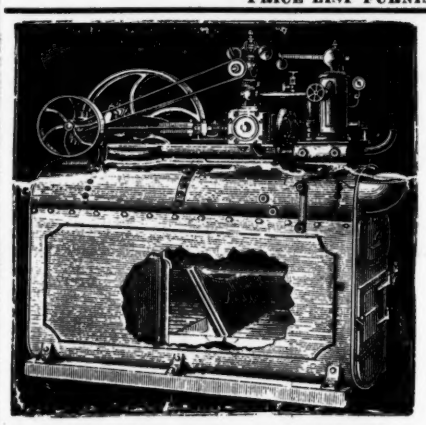

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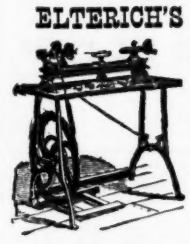

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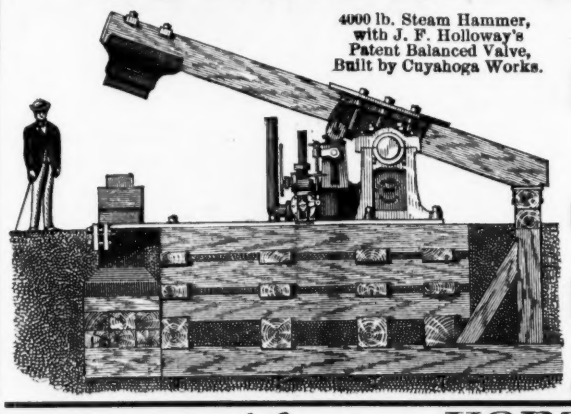

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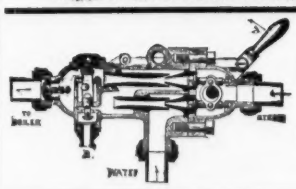

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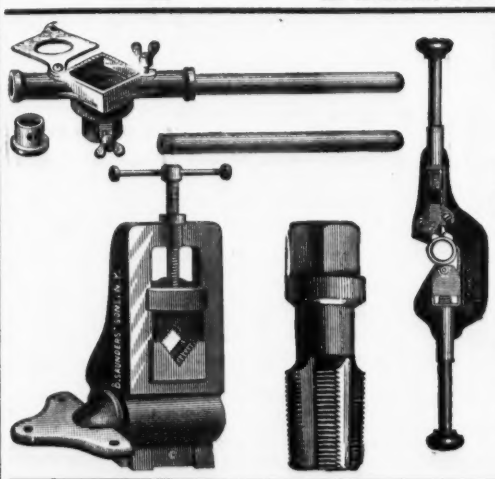

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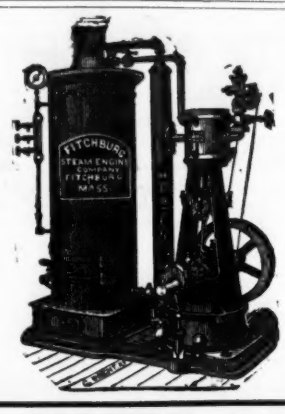

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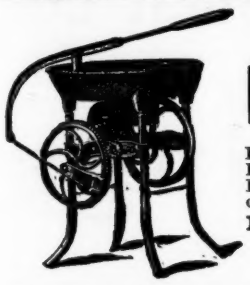

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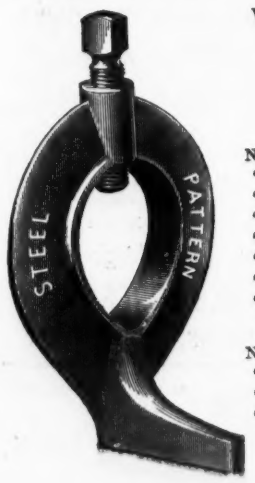

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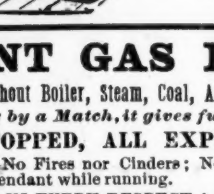

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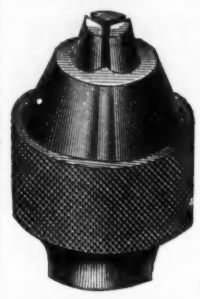

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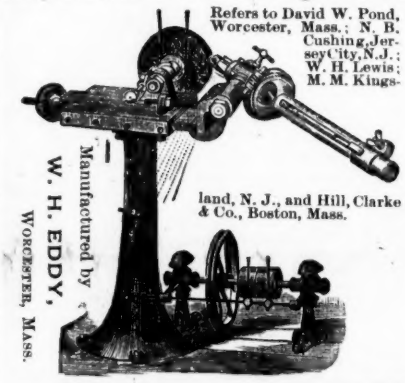

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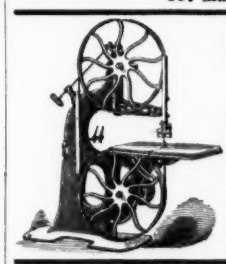

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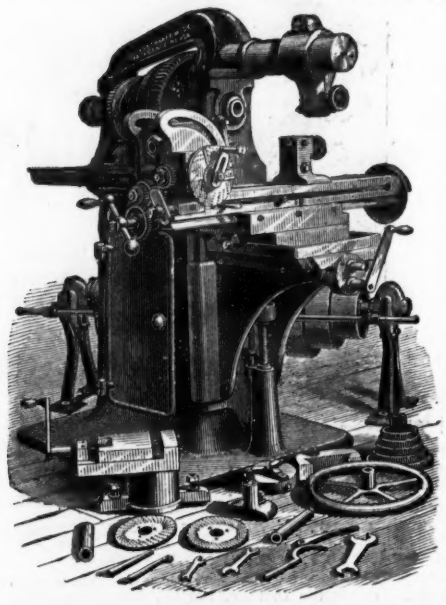

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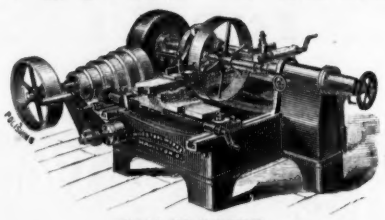

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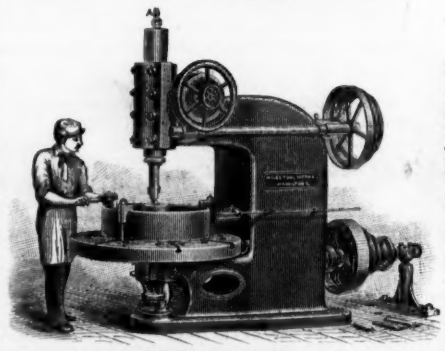

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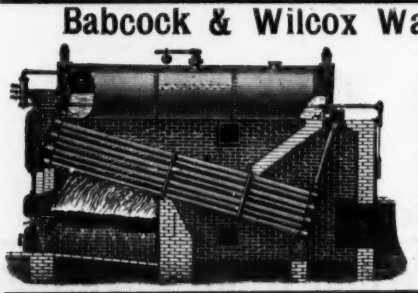

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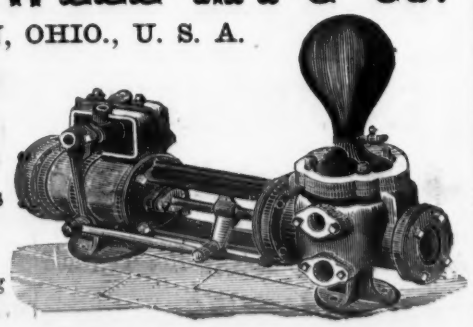

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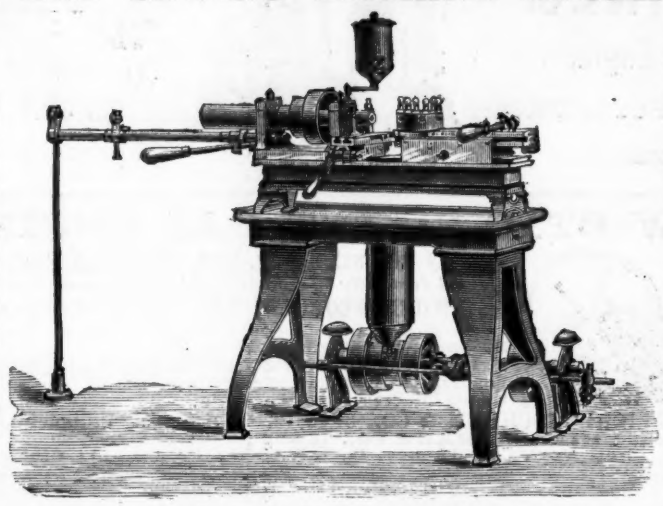

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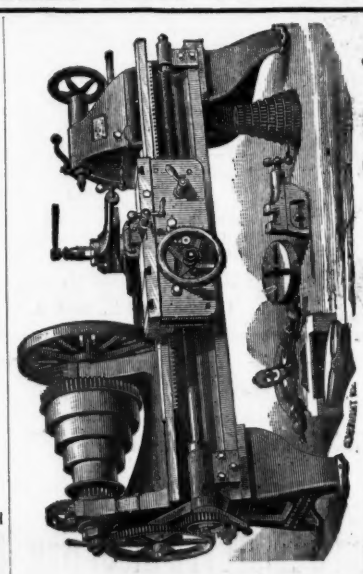

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